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Final Response to BDAT Related Comments Document D004 Characteristic Wastes for Arsenic and K, P, and U Wastes Containing Arsenic and D010: Characteristic Wastes for Selenium. Volume 1-E

(U.S.) Environmental Protection Agency, Washington, DC

May 90

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This response to comments document only addresses those comments which were submitted on the proposed land disposal restrictions for those waste codes and general BDAT technologies and issues which relate to Third Third Wastes Treatment Standards.

The commenters presented in this document are grouped according to major concerns of the commenters.

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FINAL
RESPONSE TO BDAT RELATED COMMENTS DOCUMENT

D004: Characteristic Wastes for Arsenic and K, P, and U Wastes Containing Arsenic
and
D010: Characteristic Wastes for Selenium

VOLUME I-E

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May 1990

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INTRODUCTION

This response to comments document only addresses those comments which were submitted on the proposed land disposal restrictions for those waste codes and general BDAT technologies and issues which relate to Third Third Wastes Treatment Standards.

The commenters presented in this document are grouped according to major concerns of the commenters. This document is comprised of the following sections:

ISSUE CODE 1: General BDAT Aspects
ISSUE CODE 2: D001 - Characteristic Ignitable Wastes
ISSUE CODE 3: D002 - Characteristic Corrosive Wastes
ISSUE CODE 4: D003 - Characteristic Reactive Wastes and P and U Wastes Containing Reactive Listing Constituents
ISSUE CODE 5: D004/D010 - Characteristic Wastes for Arsenic and Selenium and K, P, and U Wastes Containing Arsenic and Selenium
ISSUE CODE 6: D005 - Characteristic Wastes for Barium and P013
ISSUE CODE 7: D006 - Characteristic Wastes for Cadmium
ISSUE CODE 8: D007 - Characteristic Wastes for Chromium
ISSUE CODE 9: D008 - Characteristic Wastes for Lead P and U Wastes Containing Lead
ISSUE CODE 10: D009 - Characteristic Wastes for Mercury P and U Wastes Containing Mercury
ISSUE CODE 11: K044, K045, K047: Wastes from the Manufacturing and Processing of Explosives
ISSUE CODE 12: D011 - Characteristic Wastes for Silver
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ISSUE CODE 25: K015 - Still Bottoms from Benzal Chloride

ISSUE CODE 26: K021 - Spent Antimony Catalyst.

(No Comments Were Received for this Waste Code)

ISSUE CODE 27: K046 - WW Treatment Sludges from Manufacturing, Formulating, and Loading of Lead-Based Initiating Compounds

ISSUE CODE 28: K060 - Ammonia Still Lime Sludge.

(No Comments Were Received for this Waste Code)

ISSUE CODE 29: K061 - Electric Arc Furnace Dust

ISSUE CODE 30: K069 - Emission Control Dust/Sludge from Secondary Lead Smelting

ISSUE CODE 31: K071, K106 - Mercury Cell Process Wastes

ISSUE CODE 32: K073 - Chlorinated Hydrocarbon Wastes.

(No Comments Were Received for this Waste Code)

ISSUE CODE 33: K086 - Residues from Ink Formulation

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(No Comments Were Received for this Waste Code)

ISSUE CODE 35: Wastes Containing Cyanide

ISSUE CODE 36: K017 - Wastes from the production of Epichlorohydrin

(No Comments Were Received for this Waste Code)

ISSUE CODE 37: K028,K029, K095, K096 - Production of 1,1,1-Trichloroethane

ISSUE CODE 38: Wastewaters containing BDAT Constituents

ISSUE CODE 39: K022 - Wastes from the Production of Phenol/Acetone

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(No Comments Were Received for this Waste Code)

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(No Comments Were Received for this Waste Code)

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Commenters are identified by both commenter number and commenter name. Comments within each section of this document have been assigned a sequential comment number.

Issues were obtained from the original comment submittal and were categorized based on the grouping specified above. The Agency's response to each comment follows immediately after the text of the document. For responses related to capacity issues, the reader should review the "Response to Comments Background Document for the Third Third Land Disposal Restrictions Proposed Rule, November 22, 1989. Volume II Capacity Related Comments." For information regarding broad policy questions, the reader is directed to the "Response to Comments Background Document for the Third Third Land Disposal Restrictions Proposed Rule, November 22, 1989. Volume III Policy Related Comments."

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No Comments Were Received for this Waste Code

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ISSUE CODE 5:D004/D010 - Characteristic Wastes and K, P, and U Wastes Containing Arsenic/Selenium

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Z.-. Specification of Treatment Standards
AA.-. Segregation of Arsenic Wastes in Landfills
BB.-. Hexafluoroarsenate
CC.-. Waste Treatment Levels
EE.-. Solubilities
FF.-. Standards Deficiencies
GG.-. Data
HH.-. Chemical Fixation
II.-. Inconsistent Standards

Comment Number: 5-A-1
Docket Number: LD12-00044
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Aqueous Wastes are incompatible with vitrification
Comment:

1. Aqueous Wastes Are Not Compatible to Vitrification

Aqueous wastes including solutions, slurries, sludges and filter cakes contain too much water to vitrify in a safe and practical manner. Many arsenic compounds, including some common sodium arsenate salts, volitalize at or slightly above the boiling point of water. Rapid vaporization of the water phase during vitrification would pose severe environmental as well as practical reaction product containment problems during the treatment process.

COMMENT NUMBER: 5-A-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKem
ISSUE: Arsenic
SUBISSUE: Aqueous Wastes are not Compatible with Vitrification

RESPONSE

Aqueous wastes may be blended with dry glass making constituents as the feed to vitrification furnaces. Moisture will be evaporated during heating of the blended materials. Volatilization of arsenic compounds from the mixture in a glass furnace will be dependent on furnace design and the nature of the wastes (both physical and chemical). Amounts of arsenic emitted to the atmosphere will depend on furnace design and the type of air emissions control equipment used to treat furnace vent gases. Therefore, EPA believes a well designed vitrification furnace can handle moist wastes.

Comment Number: 5-A-2
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Aqueous waste incompatible with vitrification
Comment:

a. Aqueous Wastes Are Not Compatible To Vitrification

Aqueous wastes including solutions, slurries, sludges and filter cakes contain too much water to vitrify in a safe and practical manner. Many arsenic compounds, including some common sodium arsenate salts, volatilize at or slightly above the boiling point of water. Rapid vaporization of the water phase during vitrification would pose severe environmental as well as practical reaction product containment problems during the treatment process.

COMMENT NUMBER: 5-A-2
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Aqueous Waste is Incompatible with Vitrification

RESPONSE

Aqueous wastes may be blended with dry glass making constituents as the feed to vitrification furnaces. Moisture will be evaporated during heating of the blended materials. Volatilization of arsenic compounds from the mixture in a glass furnace will be dependent on furnace design and the nature of the wastes (both physical and chemical). Amounts of arsenic emitted to the atmosphere will depend on furnace design and the type of air emissions control equipment used to treat furnace vent gases. Therefore, EPA believes a well designed vitrification furnace can handle moist wastes.

Comment Number: 5-A-3
Docket Number: LD12-LD043
Commenter: Fermenta
Issue: Arsenic/Selenium
Subissue: Aqueous wastes are incompatible with vitrification
Comment:

Wastewater BDAT

- Fermenta concurs with EPA that chemical precipitation is the "best" performing technology for wastewater forms of arsenic-bearing wastes and that alternative technologies such as ion exchange or carbon adsorption may equal, but are unlikely to improve the level of performance. Fermenta data submitted to EPA on January 8, 1990 indicates that chemical precipitation using ferric chloride coprecipitation can successfully remove inorganic and organic arsenic from D004 and K031 wastewaters and that treatment residues are stable to groundwater leaching.

COMMENT NUMBER: 5-A-3
DOCKET NUMBER: LD12-L0043
COMMENTER: Fermanta
ISSUE: Arsenic
SUBISSUE: Chemical Precipitation Best for D004 Wastewaters

RESPONSE

The Agency appreciates Fermenta's support in this area and is pleased to learn that Fermenta's ongoing research has led to conclusions similar to those reached by the Agency. The Agency's final treatment standards are numerical and do not specify any particular method of treatment.

Comment Number: 5 - 13 - 1
Docket Number: LD12-00044
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Vitrification air emissions
Comment:

Heating to Convert Soluble Arsenic to Insoluble Metal Arsenates is not the Most Environmentally Sound Approach to Control Arsenic Evolution

Conversion of soluble arsenic salts to insoluble compounds (for instance calcium arsenate) during a vitrification process will result in some portion of the arsenic trioxide (which is generated by even moderate heating) to be evolved before it can react with calcium or other metallic ion. These escaping vapors would have to be captured by wet scrubbing devices and subsequently treated in the liquid phase. If no aqueous alkaline scrubbing is employed, these arsenic vapors will be expelled to the environment. The background information on arsenic vitrification in the Third Thirds docket does not contain any information regarding measurements of arsenic emissions during the calcination and vitrification steps.

COMMENT NUMBER: 5-B-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Air Emissions
RESPONSE

The Agency agrees that some arsenic compounds may volatilize during the vitrification process if the wastes being managed contain volatile arsenic compounds such as arsenous oxide (As_2O_3). For some wastes, chemical or thermal pretreatment may be necessary to convert the arsenic present into non-volatile arsenates such as ferric arsenate before the waste is vitrified. The background document for the proposed D004 regulations discusses the use of calcium and iron arsenates as feeds for the slag vitrification process. For glass vitrification, conversion of the arsenic to calcium or ferric arsenate before introduction into the glass making process is obviously one way of minimizing arsenic compound vapor emissions. A second method of control is capture of the arsenic oxide emitted in the air pollution control device, conversion of these captured material to non volatile ferric or calcium arsenate and subsequent vitrification of that material.

Another commenter, Rhone Poulenc (Comment No. LD12-00207), has submitted data to the Agency showing that arsenic sulfide containing wastes can be successfully vitrified. Arsenic sulfide, like the oxide, is also a volatile compound.

Also, air emissions from vitrification units can be controlled by scrubbers and other air pollution control systems. The scrubbed arsenic compounds can be recycled to the vitrification unit. Indeed, the Rhone Poulenc system involves such a recycle of captured material.

Subpart X permit requirements for vitrification units would address potential air emissions problems from arsenic.

Comment Number: 5-B-2
Docket Number: LD12-00256
Commenter: FMC Corporation
Issue: & Arsenic / Selenium
Subissue: Air Emissions
Comment:

Referring specifically to the proposed BDAT Background Document by L. Rosengrant and R. Craig, U.S. EPA, November, 1989, in section 2.1.1(3), it is noted that volatilization is normally controlled by designs using cooler roof sections and air emission control systems to collect and recycle the volatiles. However, this has not yet been tested with arsenic sulfide. Arsenic sulfide may indeed be more difficult, and the fate of the sulfur component has not been established. Until arsenic sulfide is actually tested, in full scale operation, it is not known if arsenic sulfide will perform in the same way.

COMMENT NUMBER: 5-B-2
DOCKET NUMBER: LD12-00256
COMMENTER: FMC
ISSUE: Arsenic
SUBISSUE: Air Emissions
RESPONSE

Two commenters have submitted data concerning the air emissions issue. Penberthy Electromelt (Comment No. LD12-00266) in their comments has described the use of a ceramic fiber filter in the vent gas flue from vitrification furnaces which would trap and recover particulates/arsenic oxides and sulfides. They referred to their patent (U.S.P. 4,299,611) for details. Rhone Poulenc (Comment No. LD12-00207) mentioned current development work on a recycling vapor scrubbing system but has not chosen to provide details. Neither commenter presented actual data on control of air emissions from a vitrification process. EPA is confident that these issues can be addressed successfully as part of the RCRA permitting process pursuant to Subpart X standards.

Comment Number: 5-B-3

Docket Number: LD12-00172

Commenter: HWTC

Issue: Arsenic/Selenium

Subissue: Vitrification air emissions

Comment:

b. Heating to Convert Soluble Arsenic to Insoluble Metal Arsenates is not the Most Environmentally Sound Approach to Control Arsenic Evolution

Conversion of soluble arsenic salts to insoluble compounds (for instance calcium arsenate) during a vitrification process will result in some portion of the arsenic trioxide (which is generated by even moderate heating) to be evolved before it can react with calcium or other metallic ion. These escaping vapors would have to be captured by wet scrubbing devices and subsequently treated in the liquid phase. If no aqueous alkaline scrubbing is employed, these arsenic vapors will be expelled to the environment. The background information on arsenic vitrification in the Third Thirds docket does not contain any information regarding measurements of arsenic emissions during the calcination and vitrification steps.

COMMENT NUMBER: 5-B-3
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Vitrification Air Emissions
RESPONSE

The Agency agrees that some arsenic compounds may volatilize during the vitrification process if the wastes being managed contain volatile arsenic compounds such as arsenous oxide (As_2O_3). For some wastes, chemical or thermal pretreatment may be necessary to convert the arsenic present into non-volatile arsenates such as ferric arsenate before the waste is vitrified. The background document for the proposed D004 regulations discusses the use of calcium and iron arsenates as feeds for the slag vitrification process. For glass vitrification, conversion of the arsenic to calcium or ferric arsenate before introduction into the glass making process is obviously one way of minimizing arsenic compound vapor emissions. A second method of control is capture of the arsenic oxide emitted in the air pollution control device, conversion of these captured material to non volatile ferric or calcium arsenate and subsequent vitrification of that material.

Another commenter, Rhone Poulenc, has submitted data to the Agency showing that arsenic sulfide containing wastes can be successfully vitrified. Arsenic sulfide, like the oxide, is also a volatile compound.

Also, air emissions from vitrification units can be controlled by scrubbers and other air pollution control systems. The scrubbed arsenic compounds can be recycled to the vitrification unit. Indeed, the Rhone Poulenc system involves such a recycle of captured material.

In any case, Subpart X permit requirements for vitrification units would address potential air emissions controls for arsenic.

Comment Number: 5- C-1 ✓
Docket Number: LD12-00044
Commenter: ThermalKEM/CyanoKEM
Issue: Arsenic / Selenium
Subissue: Scrubbers to control arsenic emissions from incinerators
Comment:

3. Aqueous Alkaline Wet Scrubbers are Most Practical Arsenic Vapor Removal Method

Aqueous alkaline solution scrubbers with large liquid to gas ratios are the best approach to effectively capturing and treating arsenic vapors evolved from thermal treatment (oxidation) processes such as incineration. In such processes, arsenic can be further continuously removed from the scrubber solution and treated by precipitation prior to recycling of the scrubber solution. Molten slag would be a far less effective medium in which to absorb gaseous arsenic oxides, especially when the concentration of arsenic in the vitrified product is sought to be maximized.

COMMENT NUMBER: 5-C-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Scrubbers to Control Air Emissions

RESPONSE

The Agency partially agrees with this statement. In some cases, depending on the arsenic comment of the wastes being thermally treated, additional air emissions control systems may also be needed. The Agency notes that copper smelters processing ores containing high concentrations of arsenic need to remove arsenic bearing particulates from sulfur dioxide rich gas streams used to produce sulfuric acid for sale and generally use baghouses and wet scrubbers in series to remove arsenic bearing dusts and particulates. Depending on the arsenic content of the gas stream one or more types of air emissions control equipment may be required.

Comment Number: 5-C-2
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Scrubbers to control emissions from incinerators
Comment:

c. Aqueous Alkaline Wet Scrubbers Are Most Practical Arsenic Vapor Removal

Aqueous alkaline solution scrubbers with large liquid to gas ratios are the best approach to effectively capturing and treating arsenic vapors evolved from thermal treatment (oxidation) processes such as incineration. In such processes, arsenic can be further continuously removed from the scrubber solution and treated by precipitation prior to recycling of the scrubber solution. Molten slag would be a far less effective medium in which to absorb gaseous arsenic oxides, especially when the concentration of arsenic in the vitrified product is sought to be maximized. By common ion effects the amount of arsenic that can be solubilized in the molten slag would be extremely small .

COMMENT NUMBER: 5-C-2

DOCKET NUMBER: LD12-00172

COMMENTER: HWTC

ISSUE: Arsenic

SUBISSUE: Scrubbers to Control Air Emissions

RESPONSE

The Agency partially agrees with this statement. In some cases, depending on the arsenic comment of the wastes being thermally treated, additional air emissions control systems may also be needed. The Agency notes that copper smelters processing ores containing high concentrations of arsenic need to remove arsenic bearing particulates from sulfur dioxide rich gas streams used to produce sulfuric acid for sale and generally use baghouses and wet scrubbers in series to remove arsenic bearing dusts and particulates. Depending on the arsenic content of the gas stream one or more types of air emissions control equipment may be required.

Comment Number: [illegible] 5-D-1 ✓
Docket Number: LD12-00044
Commenter: Thermal KEM/ CyanoKEM
Issue: Arsenic / Selenium
Subissue: Chemical oxidation and stabilization as BDAT
Comment: in lieu of vitrification

Aqueous Inorganic Arsenic Wastes are Best Treated by Chemical Oxidation and Precipitation

Aqueous inorganic arsenites are effectively oxidized by many common oxidants including hypochlorite, permanganate and nitric acid. Therefore, wastewaters and slurries containing these soluble arsenic compounds can be chemically oxidized to arsenic acid and then precipitated, as the stable insoluble compound ferric arsenate, in a two step reaction. Both the wastewater effluent and the non-wastewater residue are treated by this process to less than 0.5 mg/L arsenic in the liquid phase and less than 0.5 mg/L TCLP leachable arsenic in the solid phase.

COMMENT NUMBER: 5-D-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Chemical Oxidation and Precipitation
RESPONSE

The Agency agrees that treatment of aqueous inorganic arsenic wastes by oxidation and precipitation processes to convert them to insoluble arsenates is an applicable technology. In fact chemical oxidation followed by precipitation is BDAT for treatment of the wastewater forms of many arsenic bearing wastes. The Agency also notes that some non-wastewater forms of arsenic bearing wastes may have to be similarly treated to convert them into less soluble forms. Chemical oxidation and precipitation may be useful for conversion of aqueous organo arsenate solutions into insoluble ferric arsenate. The final rule does not mandate any method of treatment for arsenic nonwastewaters.

Comment Number: 5-D-2
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Chemical oxidation/stabilization BDAT
Comment:

d. Aqueous Inorganic Arsenic Wastes Are Best Treated By Chemical Oxidation And Precipitation

Aqueous inorganic arsenites are effectively oxidized by many common oxidants including hypochlorite, permanganate and nitric acid. Therefore, wastewaters and slurries containing these soluble arsenic compounds can be chemically oxidized to arsenic acid and then precipitated, as the stable insoluble compound ferric arsenate, in a two step reaction. Both the wastewater effluent and the non-wastewater residue are treated by this process to less than 0.5 mg/L arsenic in the liquid phase and less than 0.5 mg/L TCLP leachable arsenic in the solid phase.

COMMENT NUMBER: 5-D-2
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Aqueous Wastes/Chemical Treatment
RESPONSE

The Agency agrees that treatment of aqueous inorganic arsenic wastes by oxidation and precipitation processes to convert them to insoluble arsenates is an applicable technology and can treat arsenic to less than 0.5 mg/l in wastewater and nonwastewater (TCLP leachate). In fact chemical oxidation followed by precipitation is BDAT for treatment of the wastewater forms of many arsenic bearing wastes. The Agency also notes that some non-wastewater forms of arsenic bearing wastes may have to be similarly treated to convert them into less soluble forms. Chemical oxidation and precipitation may be useful for conversion of aqueous organo arsenate solutions into insoluble ferric arsenate.

Comment Number: 5-D-3
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic / Selenium
Subissue: Chemical oxidation and stabilization
Comment: as BDAT in lieu of vitrification

Considering the potentially large volume of aqueous and organic liquid arsenic wastes requiring treatment, as well as their non-wastewater treatment residues, the uncertainties surrounding potential arsenic treatment emissions and product long-term leachability do not justify vitrification as BDAT for these waste streams. Existing chemical and thermal oxidation followed by chemical aqueous arsenic precipitation is demonstrated in this submittal and those of our member companies to be best available treatment technology for these types of arsenic wastes. The HWTC urges EPA to review the submittals made by four of our member companies and to base BDAT on their technology.

COMMENT NUMBER: 5-D-3
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Chemical Oxidation/Stabilization vs BDAT
RESPONSE

The Agency has considered all of the data on chemical treatment, stabilization, and vitrification that it has received. The Agency realizes that chemical treatment followed by stabilization is a satisfactory method of treatment at least for some arsenic-bearing wastes.

The Agency, however, developed numerical treatment standards based on vitrification data. Vitrification has been successfully demonstrated on radioactive wastes containing metals. The Agency believes these wastes to be more difficult to treat than the arsenic wastes because of the radiation problems and the special controls required to prevent release to the environment. The promulgated treatment standard is concentration based and treatment facility may use whatever technology is appropriate for industrial wastes as long as the treated wastes meet that standard.

Comment Number: 5-E-1 ✓
Docket Number: LD12-00044
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Treatment of organoarsenic for incineration
Comment: in lieu of vitrification

5. Organic Arsenic Compounds are Best Treated by Thermal Oxidation

Vitrification alone would be a poor way of treating organic wastes requiring incineration, since it is a stabilization or encapsulation technology and not a destruction technology preferred for organic wastes. Therefore, vitrification cannot be considered a viable process for organically bound or dissolved arsenic wastes. On the other hand, incineration combined with an effectively designed alkaline scrubber system (e.g. sodium hydroxide solution) will not only destroy the organics but also oxidize the arsenic to arsenate in an aqueous medium which can be chemically treated as described in 4. above.

COMMENT NUMBER: 5-E-1
DOCKET NUMBER: LD12-0044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Incineration of Arsenic Waste

RESPONSE

Incineration, with proper controls to limit air emissions of arsenic, is a proper treatment technology for the destruction of organo arsenic wastes. Most commercial incinerators are not equipped with air pollution control systems capable of limiting arsenic air emissions to satisfactory levels. In fact, some incinerator operators blend low concentrations of arsenic containing materials into waste mixtures being incinerated as a means of staying within air emissions permit limitations. In the background document, the Agency pointed out that copper smelters generally use a two stage treatment system to remove arsenic compounds from sulfur dioxide containing gas streams subsequently used to produce sulfuric acid. The copper industry has felt that two stage control systems are needed to insure adequate arsenic removal capability. In any case, residuals from incineration of organo-arsenic wastes (e.g., scrubber water) are still likely to require further treatment before they can be land disposed.

The Agency still maintains that vitrification is a viable alternative to incineration. At the high temperatures used in the vitrification process organics are likely to be oxidized and organo arsenic compounds will be converted to arsenic oxides. These materials will then be vitrified and formed into the glass melt. For vitrification of wastes containing high concentrations of organics afterburners may be required to ensure destruction of organic components.

COMMENT NUMBER: 5-E-1 (continued)
DOCKET NUMBER: LD12-0044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Incineration of Arsenic Waste
RESPONSE

In any case, the Agency is setting a numerical treatment standard for arsenic. Therefore, the commenter is free to use whatever treatment technology necessary to have the wastes meet the wastewater and/or nonwastewater standards.

Comment Number: 5-E-2
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Treat organoarsenic by incineration rather than vitrification
Comment:

e. Organic Arsenic Compounds Are Best Treated By Thermal Oxidation

Vitrification alone would be a poor way of treating organic wastes requiring incineration, since it is a stabilization or encapsulation technology and not a destruction technology preferred for organic wastes. Therefore, vitrification cannot be considered a viable process for organically bound or dissolved arsenic wastes. On the other hand, incineration combined with an effectively-designed alkaline scrubber system (e.g., sodium hydroxide solution) will not only destroy the organics but also oxidize the arsenic to arsenate in an aqueous medium which can be chemically treated as described in (d) above.

COMMENT NUMBER: 5-E-2
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Incineration of Arsenic Waste
RESPONSE

Incineration, with proper controls to limit air emissions of arsenic, is a proper treatment technology for the destruction of organo arsenic wastes. Most commercial incinerators are not equipped with air pollution control systems capable of limiting arsenic air emissions to satisfactory levels. In fact, some incinerator operators blend low concentrations of arsenic containing materials into waste mixtures being incinerated as a means of staying within air emissions permit limitations. In the background document, the Agency pointed out that copper smelters generally use a two stage treatment system to remove arsenic compounds from sulfur dioxide containing gas streams subsequently used to produce sulfuric acid. The copper industry has felt that two stage control systems are needed to insure adequate arsenic removal capability. In any case, residuals from incineration of organo-arsenic wastes (e.g., scrubber water) are still likely to require further treatment before they can be land disposed.

The Agency still maintains that vitrification is a viable alternative to incineration. At the high temperatures used in the vitrification process organics are likely to be oxidized and organo arsenic compounds will be converted to arsenic oxides. These materials will then be vitrified and formed into the glass melt. For vitrification of wastes containing high concentrations of organics afterburners may be required to ensure destruction of organic components.

In any case, the Agency is setting a numerical treatment standard for arsenic. The commenter is free to use any treatment or combination of treatments to meet the numerical treatment standards.

Comment Number: 5-E-3
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic / Selenium
Subissue: Treatment of organoarsenic by incineration in lieu of vitrification
Comment:

g. EPA Inappropriately Rejects Incineration Followed by Wastewater Treatment

For the organo-arsenic compounds, EPA inappropriately rejects incineration, and claim it is not "best", because it does not destroy arsenic or selenium. However, vitrification does not destroy arsenic and selenium either. Further, the fact that treatment is required for the scrubber water is not a valid basis for EPA rejecting incineration, since the scrubber water can be subsequently treated to specific BDAT standards as part of a treatment train. The fact is that data submitted by member companies (i.e., ThermalKEM) shows that the scrubber water can be treated to levels of performance superior to vitrification.

COMMENT NUMBER: 5-E-3
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Incineration
SUBISSUE:
RESPONSE

The Agency has not rejected the use of incineration followed by chemical treatment for arsenic wastes per se. However, most commercial incinerator facilities are not equipped with the proper air emissions control equipment to incinerate concentrated arsenic wastes. In fact, it is common practice to blend wastes to meet permit requirements. Since the arsenic wastes are generated in small volumes, it seems likely that some commercial incinerators could blend arsenic-containing wastes with other incinerable materials prior to treatment. As the commenter has stated most of the arsenic present in such wastes is removed by the air emissions control scrubber water and requires further treatment. The Agency understandards that the copper industry uses more extensive arsenic emissions control systems for control of arsenic in sulfur dioxide gas streams used for sulfuric acid production. These more elaborate control systems would probably be needed by incinerators burning more concentrated arsenic wastes. The Agency realizes that incineration may be a viable option but feels that most commercial incinerators are presently not equipped to properly manage concentrated arsenic wastes.

In any case, the commenter may use any treatment method or combination of treatments to comply with the numerical treatment standard.

Comment Number: 5-E-4
Docket Number: L012-00044
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Incineration not vitrification as BDAT of organoarsenic
Comment:

7. EPA Inappropriately Rejects Incineration Followed by Wastewater Treatment

For the organo-arsenic compounds, EPA inappropriately rejects incineration, and claim it is not "best", because it does not destroy arsenic or selenium. However, vitrification does not destroy arsenic and selenium either. Further, the fact that treatment is required for the scrubber water is not a valid basis for rejecting incineration, since the scrubber water can be subsequently treated to specific BDAT standards as part of a treatment train. The fact is that ThermalKEM's data attached shows that the scrubber water can be treated to levels of performance superior to vitrification.

COMMENT NUMBER: 5-E-4
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Incineration
RESPONSE

The Agency has not rejected the use of incineration followed by chemical treatment for arsenic wastes per se. However, commercial incinerator facilities are not equipped with the proper air emissions control equipment to incinerate concentrated arsenic wastes. In fact, it is common practice to blend wastes to meet permit requirements. Since the arsenic wastes are generated in small volumes, it seems likely that some commercial incinerators could blend arsenic-containing wastes with other incinerable materials prior to treatment. As the commenter has stated most of the arsenic present in such wastes is removed by the air emissions control scrubber water and requires further treatment. The Agency understandards that the copper industry uses more extensive arsenic emissions control systems for control of arsenic in sulfur dioxide gas streams used for sulfuric acid production. These more elaborate control systems would probably be needed by incinerators burning more concentrated arsenic wastes. The Agency realizes that incineration may be a viable option but feels that most commercial incinerators are presently not equipped to properly manage concentrated arsenic wastes.

In any case, the commenter is free to use any treatment method or combination of treatments to comply with the numerical treatment standard.

Comment Number: 5-E-5
Docket Number: LD12-L0034
Commenter: HWTC
Issue: Arsenic / Selenium
Subissue: Treatment of organoarsenic by incineration
Comment:

EPA has received numerous comments against establishing vitrification as BDAT for arsenic waste. In addition, data comments have been provided separately by HWTC, CyanoKEM, ThermalKEM, Tricil and Chemfix showing that treatment of arsenic by stabilization is achievable to levels below the characteristic limit, and lower than was achievable using vitrification. The data comments of Solidiwaste (Docket #00061) regarding P010, P011 and P012 waste also supports that stabilization achieves a higher degree of treatment that vitrification for arsenic. Data submitted to the docket based on stabilization by our member companies support a maximum treatment standard at 3 ppm as opposed to the 5.6 ppm based on vitrification.

COMMENT NUMBER: 5-E-5
DOCKET NUMBER: LD12-0034
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Treatment Standards
RESPONSE

The Agency has reviewed all of the stabilization and vitrification data submitted by commenters. The stabilization data showed that with certain formulations specific wastes could be treated to below the treatment standards. In one instance, from one set of submitted data, a treatment standard of 3 ppm was calculated from a treatment consisting of chemical oxidation, precipitation, and stabilization. Overall the submitted arsenic stabilization data showed mixed results. In addition, the Agency notes that the treatment train of chemical oxidation, precipitation, and stabilization may cause a significant increase in the volume of the waste.

Vitrification data, however, showed consistent results. The Agency based its treatment standards on vitrification. Also commenters noted that vitrification can significantly reduce the volume of waste in some cases. However, individual facilities are free to use other treatment methods to comply with the treatment standards.

Comment Number: 5-E-6
Docket Number: LD12-L0043
Commenter: Fermenta
Issue: Arsenic/Selenium
Subissue: Treatment of organoarsenic by incineration in lieu of vitrification
Comment:

Although vitrification may destroy organic constituents as a side-benefit, the primary application of the technology is to capture arsenic or other hazardous constituents within a slag matrix, rendering the hazardous constituents inaccessible to the leaching action of groundwater. In proposing vitrification as BDAT for wastes deemed hazardous due to metals such as arsenic (rather than the associated organics), EPA is not necessarily relying on these vitrification devices to destroy the organics by high temperature. Thus, these devices would not necessarily be subject to full Subpart O requirements, including trial burn testing.

COMMENT NUMBER: 5-E-6
DOCKET NUMBER: LD12-L0043
COMMENTER: Fermenta
ISSUE: Arsenic
SUBISSUE: Vitrification
RESPONSE

The Agency selected vitrification because it could both immobilize arsenic and convert by oxidation organo arsenates into vitrifiable inorganic arsenic compounds. The Agency plans to permit vitrification units under Subpart X.

Comment Number: 5-F-1 ✓
Docket Number: LD12-00044
Commenter: Thermal KEM/Cyano KEM
Issue: Arsenic / ~~Cyano~~ Selenium
Subissue: Vitrification furnaces are not approved
Comment:

6. Vitrification Devices Are Not Approved as Industrial Furnaces under 40CFR260.10.

In the background document for arsenic BDAT (Docket Document No. LD12-S1030), EPA states that for organo-arsenic and organo-selenium waste, the high temperatures of vitrification will destroy the organic hazardous constituents in waste codes such as P036, P038, K031, K084, K101 and K102. Yet it is not clear how EPA intends to permit these devices. These devices are not industrial furnaces since they do not appear on the list specified under 40CFR260.10. This means that vitrification devices will have to be permitted as incinerators, since by definition in the background document EPA is relying upon these devices to destroy by high temperature the organic hazardous constituents in the waste. This would mean that these devices would be subject to full Subpart 0 requirements, including trial burn testing. This also means that the metal strategy for regulating metals emissions from incinerators will have to be applied, limiting waste feed rate consistent with the risk requirement for arsenic. When this is done EPA may find that arsenic feed must be limited to the vitrification devices to levels in the untreated waste below 1000 PPM, in order to meet the cancer risk standard for emissions of $1x10^{-5}$. At any rate, the difficult permitting process for incinerators will delay enormously the availablity of vitrification technology.

COMMENT NUMBER: 5-F-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Furnace Permitting
RESPONSE

The Agency does not believe that vitrification units meet the regulatory definition of incinerators in Section 260.10 because they do not use direct flame combustion.

As a result, vitrification units will be permitted under subpart X regulations and will have to meet designated air permit requirements for arsenic and other air emissions.

Comment Number: 5-H-1✓

Docket Number: LD12-00044

Commenter: Thermal KEM/ Cyano KEM

Issue: Arsenic/Selenium

Subissue: Chemical Treatment yields more inert

Comment: residue than vitrification

9. Chemical Treatment and Incineration followed by Wastewater Treatment Yield Waste Residue Quality for Arsenic that is more Protective of the Environment than Vitrification

The treatment performance data presented in this document shows that chemical treatment and incineration followed by wastewater treatment achieve a higher degree of treatment than vitrification, by an order of magnitude. This includes data on arsenic waste of concentrations starting as high as 40% arsenic.

Furthermore, the leachabilty treatment data for vitrification presented in EPA arsenic BDAT background document (Docket Document No. LD12-S1030) is based only on EP leachate data. TCLP is a more severe leachate test for materials such as vitrified or encapsulated materials since by TCLP test requirements the sample must be broken down to pass through an 0.9 mm opening first. The EP test, when used on slag matrices would not require the slag sample to be broken down first if it passes the "Structural Integrity Test." Slag and vitrified products should easily pass the S.I. test, and thus the EP would be carried out on monolithic lumps of material. When subjected to TCLP testing this same material would be expected to leach considerably higher arsenic levels than shown for EP results reported in the EPA arsenic BDAT background document.

COMMENT NUMBER: 5-H-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Vitrification Residues
RESPONSE

Data available to the Agency indicate that vitrification residues are as inert as the most insoluble chemical treatment residues (i.e., ferric arsenate). Furthermore, during vitrification, the Agency believes that the arsenic is incorporated into a glass matrix producing an extremely insoluble residue. Moreover in some cases, when using iron rich slags as the glass former, ferric arsenate is formed and incorporated into the glass matrix. EPA believes that vitrified ferric arsenate would be more stable than the ferric arsenate generated by a chemical treatment process.

In any case, the commenter is free to use any treatment method or combination of treatments to comply with the numerical treatment standard.

Comment Number: 5-I-1✓
Docket Number: LD12-00044
Commenter: Thermal KEM/ CyanoKEM
Issue: Arsenic / Selenium
Subissue: Chemical Treatment as BDAT for arsenic
Comment:

Since vitrification has not been operationally demonstrated, on a full scale basis, to be applicable to arsenic treatment and stabilization for aqueous inorganic wastes, (as well as organic liquids and solids) it should not be considered as BDAT for these wastes. However, because chemical or thermal oxidation followed by aqueous chemical precipitation is being used commercially as a reliable full scale treatment and stabilization process, this technology should be considered BDAT for these waste streams. Further, no capacity variance would be needed since these technologies are readily available now.

Considering environmental stability, arsenic vitrification would not be as sound a process as arsenic precipitation from an aqueous medium for the following reasons:

- There is no guarantee that vitrification will convert arsenic into water insoluble compounds. Arsenic waste streams can contain a variety of inorganic salts and ionic species. Under anhydrous vitrification conditions, various arsenic compounds could be formed that are soluble in addition to the insoluble forms in water. Water soluble arsenic species would not be chemically stable against water leaching in the environment. They would only be retained to the degree that the glass or slag encapsulating medium remains in tact. For this reason, the longer the term of exposure, the greater the risk of leaching arsenic.

Comment Number: 5-I-1 continued ✓
Docket Number: LD12-00044
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Chemical Treatment as BDAT for arsenic
Comment:

- Arsenic compounds chemically precipitated from aqueous media are automatically water insoluble. By using ferric iron salts, the form of arsenic generated can be controlled as ferric ortho-arsenate (scorodite) which is a naturally occurring stable and insoluble compound. The length of exposure to aqueous environmental conditions as well as freezing-thawing cycles does not affect its stability because it is insoluble on a molecular level. However, synthetically encapsulated mixtures of various water soluble arsenic compounds are subject to environmental cracking and matrix attrition, continually re-exposing the arsenic and allowing it to behave according to its basic solubility characteristics.

Considering the potentially large volume of aqueous and organic liquid arsenic wastes requiring treatment, as well as their non-wastewater treatment residues, the uncertainties surrounding potential arsenic treatment emissions and product long-term leachability do not justify vitrification as BDAT for these waste streams. Existing chemical and thermal oxidation followed by chemical aqueous arsenic precipitation is demonstrated in this submittal to be best available treatment technology for these types of arsenic wastes.

COMMENT NUMBER: 5-I-1
DOCKET NUMBER: LD12-00044
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: BDAT Standards
RESPONSE

The Agency has examined all of the data for numerous treatment methods and has established treatment standards based on vitrification data. Facilities, however, are free to use other treatment methods to comply with the standards.

The Agency notes that TCLP leachate values submitted for vitrified arsenic sulfide containing wastes were well below the characteristic level indicating that the arsenic had become fixed in the glass matrix. The TCLP test is more rigorous than the EP toxicity test and would be expected to reveal the presence of unreacted arsenic compounds present as discrete phases trapped inside glass matrices. As a result, the Agency does not believe that long-term exposure will lead to leaching of significant amounts of arsenic or arsenic compounds.

Comment Number: 5-I-2 ✓
Docket Number: LD12-00269
Commenter: ASARCO
Issue: Arsenic / Selenium
Subissue: Chemical Treatment as BDAT for arsenic
Comment:

Arsenic

Depending on the treatment standard to be met, lime alone may be sufficient. If arsenic is +3, it will have to be oxidized to +5.

Sulfide precipitation of arsenic works only below a pH of 2.0 particularly when sodium sulfide is used as reagent. Arsenic sulfide (both +3 and +5 sulfides) are very colloidal and almost impossible to filter.

Ferric salts can be used to produce basic ferric arsenate (as ferric arsenate +5), which is more stable than calcium arsenate.

The Agency should not specify the reagent to be used.

Comment Number: 5-I-2 continued
Docket Number: LD12-00269
Commenter: ASARCO
Issue: Arsenic / Selenium
Subissue: Chemical Treatment as BDAT for arsenic
Comment:

Selenium

Selenium cannot be treated with lime.

Selenium can be removed by sulfide treatment. Again, as with arsenic, pH less than 2.0 is needed. However, contrary to the assumption that arsenic and selenium are similar, sulfide treatment of selenium wastewaters produces elemental S and Se. It is also inappropriate to literally translate treatability from one metal to another since the compounds produced by treatment are different and have different solubilities. Even if sulfides were produced in both cases, their solubilities are likely to be different.

COMMENT NUMBER: 5-I-2
DOCKET NUMBER: LD12-00269
COMMENTER: ASARCO
ISSUE: Arsenic/Selenium
SUBISSUE: Treatment Methods
RESPONSE

The Agency thanks ASARCO for the information provided on treatment of wastewaters with sulfide at pH 2 or below. The information provided corroborates that already known by the Agency.

It is not the Agency's intention to specify a reagent. The commenter is free to use any treatment reagent(s) to meet the treatment standards.

Comment Number: 5-I-3
Docket Number: LD12-00172.
Commenter: HWTC
Issue: Arsenic / Selenium
Subissue: Chemical treatment as BDAT
Comment: for arsenic

I. Chemical Treatment And Incineration Followed By Wastewater Treatment Yield Waste Residue Quality For Arsenic That Is More Protective Of The Environment Than Vitrification

The treatment performance data presented in this document shows that chemical treatment and incineration followed by wastewater treatment achieve a higher degree of treatment than vitrification, by an order of magnitude. This includes data on arsenic waste of concentrations starting as high as 40% arsenic.

Furthermore, the leachability treatment data for vitrification presented in EPA arsenic BDAT background document (Docket Document No. LD12-S1010) is based only on EP leachate data. TCLP is a more severe leachate test for materials such as vitrified or encapsulated materials since by TCLP test requirements the sample must be broken down to pass through an 0.9 mm opening first. The EP test, when used on slag matrices would not require the slag sample to be broken down first if it passes the "Structural Integrity Test." Slag and vitrified products should easily pass the S.I. test, and thus the EP would be carried out on monolithic lumps of material. When subjected to TCLP testing this same material would be expected to leach considerably higher arsenic levels than shown for EP results reported in the EPA arsenic BDAT background document.

COMMENT NUMBER: 5-I-3
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Residue Stability
RESPONSE

Data available to the Agency indicate that vitrification residues are as inert as the most insoluble chemical treatment residues (i.e., ferric arsenate). Furthermore, the Agency believes that the arsenic is incorporated into a glass matrix producing an extremely insoluble residue. Moreover in some cases, when using iron rich slags as the glass former, ferric arsenate is formed and incorporated into the glass matrix. EPA believes that vitrified ferric arsenate would be more stable than the ferric arsenate generated by a chemical treatment process. Also, the Agency believes that conversion to ferric arsenate followed by stabilization will significantly increase the volumes of wastes being land disposed, an undesirable feature of the technology.

The Agency notes that TCLP leachate values submitted for vitrified arsenic sulfide-containing wastes were well below the characteristic level indicating that the arsenic had become fixed in the glass matrix. The TCLP test is more rigorous than the EP toxicity test and would be expected to reveal the presence of unreacted arsenic compounds present as discrete phases trapped inside glass matrices. As a result, the Agency does not believe that long-term exposure will lead to leaching of significant amounts of arsenic or arsenic-containing compounds.

Comment Number: 5-J-1✓
Docket Number: LD12-00073
Commenter: CHEMFIX
Issue: Arsenic/ Selenium
Subissue: Alternative Technologies to vitrification
Comment:

While the proposed non-wastewater standard is even above the old "D" standard of 5.0 ppm, the agency seems to believe that only vitrification is a suitable treatment technology. I would like to point out that on page 43460 the EPA has stated that "...wastes may be treated with any treatment technology capable of meeting the standards." I think it appropriate to state to the EPA that "alkaline stabilization" can be made to work on the fixation of at least some arsenic contaminated streams. Further, it is **correct** to state that an alkaline stabilization system such as the CHEMSET™/ CHEMFIX® Process does not make the leachability of arsenic worse.

I have attached data from (1) K-048 sludge stabilization and (2) An acic production by product liquid with a very high arsenic concentration. In each o the cases, a CHEMSET™/CHEMFIX® Process was employeed.

COMMENT NUMBER: 5-J-1
DOCKET NUMBER: LD12-00073
COMMENTER: CHEMFIX
ISSUE: Arsenic
SUBISSUE: Alternatives to Vitrification
RESPONSE

Wastes may be treated with any treatment technology capable of meeting the standards. For wastes where CHEMFIX technologies are viable, they may be utilized.

The data submitted by the commenter consisted of stabilization test data on two samples of wastes. One sample was a K048 waste containing very low levels of arsenic. The second was a D004 nonwastewater containing 73,000 mg/kg of arsenic. The commenter has pointed out stabilization can be made to work for at least some types of D004 wastes. The Agency, however, based its standards on vitrification data because the available vitrification data gave superior results for a broader range of D004 wastes.

Comment Number: 5-J-2
Docket Number: LD12-00110
Commenter: Thermal KEM/ CyanoKEM
Issue: Arsenic / Selenium
Subissue: Alternative Technologies to Vitrification
Comment:

D004 Arsenic Bearing Wastes

ALTERNATE TECHNOLOGY THAN THE PROPOSED VITRIFICATION IS MORE APPROPRIATE FOR D004, D010, K031, K084, K101, K102, P010, P011, P012, P036, P038, P103, P114, U136, U204, U205 WASTES

The proposed arsenic and selenium BDAT based on studies performed at the University of Montana on Vitrification is not best demonstrated achievable technology. For these wastes we urge EPA to consider the demonstrated, available technology used at our two operating facilities. We have provided comprehensive data and process descriptions in a report submitted to the docket for LD12 on December 22, 1989. This report describes treatment of arsenic bearing inorganic waste streams, as well as incineration combined with scrubber water treatment for organo-arsenic waste. The treatment data provided supports a BDAT standard for non-wastewater residuals of 2.99 PPM, lower than the proposed standard of 5.6 PPM based on vitrification. The untreated waste contained 40% arsenic, higher than the waste used to evaluate vitrification technology. Since a 2.99 PPM standard is below the characteristic level, EPA should clearly establish this standard as BDAT.

In our report submitted December 22, 1989, a critique of the vitrification technology is provided, that details 12 major problems with this proposed BDAT. One of the most serious is that no accounting has been made for the arsenic emitted to the air during the calcination process.

Since vitrification has not been operationally demonstrated to be applicable to arsenic treatment and stabilization for aqueous inorganic wastes, (as well as organic liquids and solids) it should not be considered as BDAT for these wastes. However, because chemical or thermal oxidation followed by aqueous chemical precipitation is being used commercially as a reliable full scale treatment and stabilization process, this technology should be considered BDAT for these waste streams. Further, no capacity variance would be needed, since these technologies are readily available now.

COMMENT NUMBER: 5-J-2
DOCKET NUMBER: LD12-00110
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Alternatives to Vitrification
RESPONSE

The Agency has considered all of the data submitted for both vitrification and stabilization of D004 wastes. Overall, the stabilization data showed that with proprietary treatments at least some wastes could be properly managed with or without chemical pretreatment. On the other hand, the Agency is aware of numerous arsenic stabilization tests that have shown little or no treatment.

The Agency found that both vitrification and some chemical treatment and stabilization processes could treat the widely diverse arsenic wastes to levels below the treatment standard. Vitrification results, however, pointed to a broader applicability. Facilities may use either of the technologies to meet the standards.

Comment Number: 5-J-3
Docket Number: LD12-00233
Commenter: UNOCAL Corporation
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

FLEXIBILITY

Unocal would like to insure that the EPA provides for the development of new and different treatment technologies that can be incorporated into the regulatory process. Many companies are independently testing and evaluating different kinds of technologies that may prove to be extremely effective means for treatment of hazardous wastes, and we want to be assured that these technologies are not precluded by an already determined technology.

An example of how this flexibility can benefit and produce real progress in the treatment of hazardous wastes, and why the risk-based screening level approach is the most appropriate, is discussed below.

Unocal's Parachute Project in Colorado is an oil shale retort facility which generates spent catalyst (SOAR-100) containing high concentrations of arsenic (30% by weight). The catalyst currently cannot be regenerated or recycled due to this high arsenic content. Consequently, the catalyst becomes a waste and is hazardous due to Extraction Procedure (EP) toxic levels for arsenic exceeding 900 ppm. As such, the catalyst is currently encapsulated and landfilled as a hazardous waste at the USPCI facility in Utah.

Under EPA's proposed third-third ruling, this waste can no longer be landfilled beyond May 8, 1990, unless it can be treated to an established standard. EPA is proposing in their November ruling a treatment standard of 5.6 ppm for non-wastewater arsenic wastes. This standard was based on a research study using a vitrification (glass encapsulation) process to stabilize high arsenic waste. The vitrification process appears to be viable, but will most likely be very expensive, and it is not currently available on a commercial scale. EPA has recognized this problem, and is proposing in their ruling a two-year national capacity variance for [illegible]

Comment Number: 5-J-3 (Contd)
Docket Number: LD12-00233
Commenter: UNOCAL Corporation
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

Unocal supports the EPA decision to grant a two-year capacity variance to all of the surface-disposed arsenic wastes. A two-year variance will provide needed time for the development and validation of arsenic stabilization procedures. However, Unocal does not believe that vitrification is the only acceptable arsenic stabilization procedure.

We are currently in the process of determining whether other stabilization techniques are capable of treating the catalyst to arsenic concentration at or below the proposed TLCP level of 5.6 ppm. Samples of the catalyst have been sent to three different companies to test their respective stabilization processes. To date, two of the companies, which use multiple phase lime base processes, have indicated that their processes were successful in stabilizing the catalyst to levels below 5.6 ppm. However, so far the testing has only been on a laboratory scale. Additional testing will be necessary for developing the processes to a commercial level.

Nevertheless, it appears that other stabilization processes may be available, and Unocal is proposing that alternate methods that satisfy the specified concentration standards should be included as acceptable treatment procedures.

COMMENT NUMBER: 5-J-3
DOCKET NUMBER: LD12-00233
COMMENTER: Unocal
ISSUE: Arsenic
SUBISSUE: Alternatives to Vitrification

RESPONSE

The numerical D004 nonwastewater standards have been developed from data demonstrating the treatment performance of a vitrification process. Individual facilities are free to use other waste treatment technologies in order to achieve these standards. The Agency encourages industry to development technologies equivalent to or better than BDAT.

Comment Number: 5-J-4
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

Considering environmental stability, arsenic vitrification would not be as sound a process as arsenic precipitation from an aqueous medium for the following reasons:

- There is no guarantee that vitrification will convert arsenic into water insoluble compounds. Arsenic waste streams can contain a variety of inorganic salts and ionic species. Under anhydrous vitrification conditions, various arsenic compounds could be formed that are soluble in addition to the insoluble forms in water. Water soluble arsenic species would not be chemically stable against water leaching in the environment. They would only be retained to the degree that the glass or slag encapsulating medium remains in tact. For this reason, the longer the term of exposure, the greater the risk of leaching arsenic.

- Arsenic compounds chemically precipitated from aqueous media are automatically water insoluble. By using ferric iron salts, the form of arsenic generated can be controlled as ferric ortho-arsenate (scorodite) which is a naturally occurring stable and insoluble compound. The length of exposure to aqueous environmental conditions as well as freezing-thawing cycles does not affect its stability because it is insoluble on a molecular level. However, synthetically encapsulated mixtures of various water soluble arsenic compounds are subject to environmental cracking and matrix attrition, continually re-exposing the arsenic and allowing it to behave according to its basic solubility characteristics.

COMMENT NUMBER:	5-J-4
DOCKET NUMBER:	LD12-00172
COMMENTER:	HWTC
ISSUE:	Arsenic
SUBISSUE:	Alternatives to Vitrification

RESPONSE

During the comment period, the Agency received additional information on vitrification technology. One commenter (Penberthy Electromelt Inc., Comment No. LD12-00266)) pointed out that in a properly operated vitrification system, the arsenic should form a solution in the glass and thus be unavailable for subsequent release. A second commenter, Rhone Poulenc (Comment No. LD12-00207) provided TCLP leachate data on vitrified arsenic sulfide waste which showed that the arsenic had been successfully incorporated into a glass matrix. The Agency has based its standard on vitrification. However, facilities are free to use other methods to comply with the standard.

The Agency notes that TCLP leachate values submitted for vitrified arsenic sulfide-containing wastes were well below the characteristic level indicating that the arsenic had become fixed in the glass matrix. The TCLP test is more rigorous than the EP toxicity test and would be expected to reveal the presence of unreacted arsenic compounds present as discrete phases trapped inside glass matrices. As a result, the Agency does not believe that long-term exposure will lead to leaching of significant amounts of arsenic or arsenic compounds.

Comment Number: 5-J-5
Docket Number: LD12-L0031
Commenter: Thermal KEM/ CyanoKEM
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

A. American NuKEM Comments on Unocal Corporation Comments on Application of proposed rule for Land Disposal Restrictions for Third Third Scheduled Wastes with respect to Arsenic Standard for Non-wastewater Treatment Residues.

American NuKEM agrees with comments submitted to Docket #F-89-LD12-FFFFF by Union Oil Company of California that there are other treatment and stabilization technologies available, besides vitrification, that can achieve less than 5.6 mg/L TCLP extract arsenic concentration in non-wastewater treatment residues. American NuKEM has demonstrated a chemical oxidation/ precipitation and stabilization process for arsenic waste treatment residues containing in excess of 30% arsenic by weight on a laboratory basis. In fact, one of the wastes used to demonstrate these levels of arsenic treatment by this technology was a sample of Unocal's (SOAR-100) spent catalyst containing 30% by weight arsenic.

These results, as well as demonstrated full-scale plant treatment results for up to 70% arsenic wastes by incineration-scrubber wastewater treatment train, were submitted in American NuKEM's comments to Docket #F-89-LD12 in December 1989. We concur with Unocal that vitrification is not the only acceptable arsenic stabilization procedure. In fact, we have serious concerns over safety and environmental hazards such a process can perpetuate through fugitive arsenic emissions as well as the vitrified residue integrity in the environment over extended time periods. We believe that such a process should not be adopted as BDAT without adequate full-scale testing, studies and demonstrations.

Comment Number: 5-J-5 (Cont)
Docket Number: LD12-L00B1
Commenter: Thermal KEM / CyanoKEM
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

C. American NuKEM Comments on Solidiwaste Technology Comments Concerning BDAT for P010, P011 and P012 Arsenic Wastes

American NuKEM supports these comments to the extent that it demonstrates that other technologies are available, including chemical stabilization processes, that are equal or superior to vitrification for treatment on arsenic non-wastewater. The technologies are demonstrated for low as well as high concentration arsenic wastes.

COMMENT NUMBER:	5-J-5
DOCKET NUMBER:	LD12-L0031
COMMENTER:	ThermalKEM
ISSUE:	Arsenic
SUBISSUE:	Alternatives to Vitrification

RESPONSE

The Agency has reviewed the vitrification process and data received on vitrification of wastes. The Agency agrees with the commenter that air emissions control units such as afterburners and scrubbers may be required for vitrification units to control fugitive arsenic emissions. One commenter, Rhone Poulenc (Comment No. LD12-00207) has indicated they are incorporating such features into scale-up of their small scale patented vitrification system.

The Agency also agrees with the commenter that stabilization may be sufficient for some types of arsenic wastes. However, the Agency is aware of numerous arsenic stabilization tests that have shown little or no treatment. The numerical treatment standards are based on vitrification. However, facilities are free to use other methods to comply with the treatment standards.

Comment Number: 5-J - 6
Docket Number: LD12 - L0043
Commenter: Fermenta
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

Washing processes have been investigated for removing arsenic from soil and from the salt cake. These investigations indicate that ferric chloride coprecipitation is a suitable technology for arsenic removal from arsenic containing wastewaters and K031 brines (produced by dissolving K031 salt cake in wastewaters), as an alternative to vitrification.

Since the arsenic wastes that are covered by the EPA proposal vary from inorganic to organic and are so varied in composition (ranging from salt to flue dusts and contaminated soil and debris), treatment methods which are appropriate for one arsenic waste may be entirely inappropriate for another waste. The treatment method of choice will depend on the form of arsenic, other waste constituents present, and the arsenic concentration. Thus, Fermenta strongly supports concentration-based standards rather than technology standards. Concentration-based standards will allow a variety of treatment methodologies, appropriate to a particular waste, to be employed.

2

Comment Number: 5-J-6 continued
Docket Number: LD12- L0043
Commenter: Fermenta
Issue: Arsenic / Selenium
Subissue: Alternative technologies to vitrification
Comment:

Nonwastewater BDAT

- Fermenta concurs with EPA that incineration is not "best" for arsenic containing nonwastewaters such as K031 salt cake. Although incineration might destroy the small amount of organics present in the waste, extensive scrubbing and precipitation equipment would be required to trap volatilized arsenic. Since precipitation and fixation may be possible without incineration, the expensive energy requirements of incineration cannot be justified. In the case of incineration of MSMA, a more toxic inorganic form of arsenic would be volatilized which is difficult to contain. In addition, incineration of K031 salt cake (which is almost entirely sodium chloride and sodium sulfate salt) would require specialized refractory and metallurgy which is not available in existing commercial incinerators. Although some organic arsenic wastes can be incinerated, no incineration of K031 salt cake from MSMA manufacture has been demonstrated. Fermenta has not been able to find commercial incinerator operators able to incinerate K031 waste. As a minimum, significant dilution with other wastes would be necessary in order to reduce sodium and arsenic content to acceptable levels. This would result ~~in a significant increase in~~ "derived-from" residues.

COMMENT NUMBER: 5-J-6

DOCKET NUMBER: LD12-L0043

COMMENTER: Fermenta

ISSUE: Arsenic

SUBISSUE: Alternatives to Vitrification

RESPONSE

The Agency is setting concentration-based treatment standards for the final rulemaking for D004. Facilities may use any technology or combination of technologies to comply with the numerical treatment standards.

Concerning the listed waste K031, the Agency's data indicates it contains both inorganic and organic compounds of arsenic. Inorganic arsenic may be precipitated as ferric arsenate. Arsenites and organoarsenic compounds should be oxidized to arsenates before precipitation with ferric ion to achieve quantitative removal of arsenic from wastewaters. Ferric precipitation alone, the Agency believes, may not provide sufficient for treatment of wastewaters containing various forms of arsenic. Also, ferric salts of organoarsenic compounds may undergo chemical changes due to oxidation with time possibly releasing arsenic at future dates.

Comment Number: 5-J-7
Docket Number: LD12-L0043
Commenter: Fermenta
Issue: Arsenic/Selenium
Subissue: Alternative technologies to vitrification
Comment:

Fermenta data presented to EPA on January 8, 1990 shows that chemical fixation is a promising alternative technology to vitrification, particularly for certain wastes. However, Fermenta's research indicates that the chemicals needed to fix arsenic are quite waste specific, and no universal treatment exists. Thus, proprietary processes such as Chemset/Chemfix or Urrichem which may be appropriate for particular wastes, may be entirely inappropriate for others. Fermenta concurs with EPA data which indicate that many fixation treatments achieve acceptable leachate values largely by dilution. Thus, it is impossible to evaluate proprietary vendor claims which are not supported by sufficient data to make mass balances or which do not fully characterize the waste being treated.

COMMENT NUMBER: 5-J-7
DOCKET NUMBER: LD12-L0043
COMMENTER: Fermenta
ISSUE: Arsenic
SUBISSUE: Alternative Treatment
RESPONSE

The commenter supports the Agency's position for setting a concentration-based treatment standard for D004 at the level of 5 mg/l. As noted by the commenter, there are a wide diversity of arsenic-containing wastes that may require different treatments and stabilizing binders. The Agency has data (from vitrification and some stabilization tests) indicating that arsenic-containing hazardous wastes can be treated below the numerical treatment standard.

The Agency recognizes that some fixation processes, if preceded by chemical or thermal oxidation to convert arsenic to the arsenate form, may be viable alternatives to vitrification. However, chemical fixation of organoarsenic compounds directly may only provide a temporary measure of protection. Organoarsenic compounds will slowly oxidize, thus possibly releasing the arsenic to the environment. The Agency has attempted to stabilize K031 wastes directly without success.

1

Comment Number: 5-K-1

Docket Number: LD12-00183

Commenter: Southern Pacific Transportation Company

Issue: Arsenic / Selenium

Subissue: Vitrification is not demonstrated

Comment:

II. Vitrification Should Not be the Remedial Technology for the Crystal Site Soils and Should Not Be Selected as the BDAT for K031 Nonwastewaters

Vitrification should not be selected as the remedial technology for Crystal site soils or as the BDAT for K031 nonwastewaters because it has not been demonstrated. According to EPA, a treatment technology is considered to be demonstrated based primarily on data from full-scale treatment operations that are currently being used to treat the waste or a similar waste. 54 Fed. Reg. 48,380 (1989). The proposed background document for K031 wastes (Background Document) also states that:

> To be demonstrated, the technology must be employed in a full-scale operation for the treatment of the waste in question or a similar waste. Technologies available only at pilot- and bench-scale operations are not considered in identifying demonstrated technologies.

Background Document at 2-1. Mr. Jim Berlow, Section Chief of the EPA Waste Treatment Section, advised AES on November 1, 1989 that EPA had only one pilot scale study of arsenic contaminated soils, which was performed at Montana State University, to support the proposed BDAT for K031 wastes. Southern Pacific has unsuccessfully attempted to obtain this study through the Freedom of Information Act process. Under EPA's own criteria, a pilot scale study is inadequate to conclude that vitrification has been demonstrated.

Comment Number: 5-K-1 continued
Docket Number: LD12-00183
Commenter: Southern Pacific Transportation Company
Issue: Arsenic / Selenium
Subissue: Vitrification is not demonstrated
Comment:

Full-scale vitrification processes used to treat radioactive and other hazardous wastes containing metals and arsenic cannot be used to show that vitrification is demonstrated for K031 wastes. See Background Document at 2-9. EPA's conclusion that vitrification is demonstrated because radioactive wastes are more difficult to treat is arbitrary because it is not based on performance data. Unless the radioactive properties in the soils treated by vitrification were the same as soils contaminated with K031 wastes, EPA cannot jump to this conclusion without a rational basis.

Insufficient data exists to determine whether vitrification may be applicable on a full-scale basis. According to the Background Document, "[t]o be applicable, a technology must be theoretically usable to treat the waste in question or to treat a waste that is similar in terms of the parameters that affect treatment selection." Background Document at 2-1. Representatives of Geosafe Corporation, the company that has the exclusive license to provide onsite vitrification remediation services, admit that:

Comment Number: 5-K-1continued
Docket Number: L012-00183
Commenter: Southern Pacific Transportation Company
Issue: Arsenic / Selenium
Subissue: Vitrification is not demonstrated
Comment:

> Many site- and application-specific variables affect the disposition of specific contaminants. The primary variables include physical and chemical properties of contaminants, melt chemistry, melt temperature, contaminant dwell time in the treatment zone, adjacent soil properties, soil moisture content, and extent of overmelting (soil melted beyond the limit of contamination). Because of the many site-specific variables involved, it is necessary to consider each remediation project individually.

Hansen and Fitzpatrick, In-Situ Vitrification: Heat and Immobilization are Combined for Soil Remediation, 30 Hazmat World 30 (Dec. 1989). Severe limiting factors on the effectiveness of in situ vitrification can be the elemental composition of the soil and the homogeneity of the surface soils. Some soils are not amenable to this technology because they do not contain the constituents required to effectively vitrify or melt the soil. Nonhomogenous soils can result in the melt moving in a preferential pathway. The contaminant being treated can also have an effect on the success of the vitrification process. Many contaminants, including metals and organics, can migrate away from the melt zone, thus contaminating other clean soils which would otherwise have to be treated. The technology therefore has not been shown to be applicable.

COMMENT NUMBER: 5-K-1
DOCKET NUMBER: LD12-00183
COMMENTER: Southern Pacific
ISSUE: Arsenic
SUBISSUE: Vitrification is Undemonstrated
RESPONSE

At the time the draft background document was prepared, the only information the Agency had on vitrification of arsenic wastes was the pilot scale study cited by the commenter. However, the Agency also had information showing the process was in full scale use for treatment and management of radioactive wastes which are more difficult to treat because of the associated radiation hazards. Since proposal, the Agency has received additional information from two commenters (Rhone Poulenc, Comment No. LD12-00207; Penberthy, Comment No. LD12-00266; PPG, Comment No. LD12-00133) both providing background on vitrification of arsenic sulfide-containing wastes and giving further information on the applicability of the process to a wide range of wastes, particularly those containing a number of EP toxic metal constituents. Arsenic sulfide, like the organoarsenic constituents of K031, is susceptible to oxidation to arsenic oxides during the vitrification process.

The numerical treatment standard was developed from vitrification data. However, facilities are free to use other technologies to comply with the regulation.

Comment Number: 5-K-2
Docket Number: LD12-00256
Commenter: FMC Corporation
Issue: Arsenic / Selenium
Subissue: Vitrification is not demonstrated
Comment:

FMC Corporation wishes to comment in two areas related to the present status of the vitrification technology which was selected as BDAT. First, the vitrification data available is for arsenic oxide or calcium arsenate, not for arsenic sulfide; and, second, no full scale operation has been run on arsenic sulfide (or a similar waste). We therefore do not believe that the vitrification technology stands "demonstrated" for arsenic sulfide wastes generated by the phosphoric acid industry.

Similarly, section 3.1.3 reports vitrification of calcium arsenate, but not arsenic sulfide. The conversion of arsenic oxide to calcium arsenate is interesting, but does not address requirements for a similar conversion for arsenic sulfide. Further, this section reports data for vitrification in iron silicate slag only; not in normal glass making.

In the index to the Background Document, the subject of item LDR12-Ref S0036 is listed as "Vitrification of Arsenic Sulfide Secondary Material". The document, however, makes only an oblique reference to "...discussion with generators of this Secondary Material which arises during phosphoric acid production." The subject then switches to arsenic oxide, which we maintain is not "similar" because of the complications of the sulfur component.

The chapter on Electric Melting of Glass from the Handbook of Glass Manufacture (1974) which is attached to Ref S0036, while it refers to the "...capture of volatile batch ingredients...", mentions neither arsenic nor compounds containing sulfur. Nowhere in this reference is there a statement that arsenic sulfide has been used in a full scale test; nor is there any specific data reported.

Concerning the scale of arsenic vitrification that has been tested, section 2.2.1(3) of the Proposed Background Document states that only pilot-scale tests of arsenic wastes (non-sulfide) have been run. Again, while section 4.1 outlines how vitrification may be the "best" technology that EPA has identified, it does not stand "demonstrated" for arsenic sulfide at the present time.

COMMENT NUMBER: 5-K-2
DOCKET NUMBER: LD12-00256
COMMENTER: FMC Corporation
ISSUE: Arsenic
SUBISSUE: Vitrification Not Demonstrated
RESPONSE

The Agency has received two comments indicating the viability of vitrification of arsenic sulfide bearing wastes. Rhone-Poulenc (Comment No. LD12-00207) submitted data from a number of trial runs with vitrification equipment they have developed for potential use in vitrification of arsenic sulfide bearing sludges from production of phosphoric acid. The data show the vitrified solids additionally meet the treatment standards.

Penberthy Electromelt International, Inc. (Comment No. LD12-00266), a manufacturer of electric glass furnaces, has commented that arsenic sulfides can be used in place of the oxide in glass production.

The Agency thus feels that vitrification of arsenic sulfide is viable as a treatment technology and has determined it is BDAT for D004. The final rulemaking for D004, however, is a numerical standard and facilities may use any treatment method or combination of treatment methods for compliance.

Comment Number: 5-K-3
Docket Number: LD12-L0031
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Vitrification is not demonstrated
Comment:

Also, as we have previously submitted in our December 22, 1989 comments on arsenic BDAT to Docket No. F89-LD12-FFFFF, we agree with Solidiwaste Technology's assertion that TCLP would be a more rigorous test than EP for vitrified materials and would likely result in greater than 5.6 ppm leachable arsenic. Therefore, EPA should not set vitrification as BDAT for arsenic wastes.

COMMENT NUMBER: 5-K-3
DOCKET NUMBER: LD12-L0031
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Vitrification is Not Demonstrated
RESPONSE

The Agency has received two comments indicating the viability of vitrification of arsenic bearing wastes. Rhone-Poulenc (Comment No. LD12-00207) submitted data from a number of trial runs with vitrification equipment they have developed and potential for use in vitrification of arsenic sulfide bearing sludges from production of phosphoric acid. The data show the vitrified solids additionally meet the treatment standards using the TCLP test.

The Agency used an EP based standard instead of a TCLP based value because most of the data submitted was EP based. However, the Rhone Poulenc information is based on TCLP tests.

The Agency notes that TCLP leachate values submitted for vitrified arsenic sulfide-containing wastes were well below the characteristic level indicating that the arsenic had become fixed in the glass matrix. The TCLP test is more rigorous than the EP toxicity test and would be expected to reveal the presence of unreacted arsenic compounds present as discrete phases trapped inside glass matrices. As a result, the Agency does not believe that long-term exposure will lead to leaching of significant amounts of arsenic or arsenic-containing compounds.

Penberthy Electromelt International, Inc. (Comment No. LD12-00266), a manufacturer of electric glass furnaces, has commented that arsenic sulfides can be used in place of the oxide in glass production. Penberthy also stated that in a properly operated system, the arsenic dissolves in the glass formed.

The Agency thus feels that vitrification of arsenic sulfide is viable as a treatment technology.

Comment Number: 5-K-4
Docket Number: LD12-L0034
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: VAritfication is not demonstrated
Comment:

In addition, to the HWTC and its member companies, numerous industry groups have provided data critical of the proposed vitrification standard for arsenic waste, including Unocal, Monsanto, and Allied Signal. These groups have urged EPA to set a numeric treatment standard rather than vitrification as a technology.

Also, as we have previously submitted in our comments on arsenic BDAT to Docket No.F89-LD12-FFFFF, we agree with Solidiwaste Technology's assertion that TCLP would be a more rigorous test than EP for vitrified materials and would likely result in greater than 5.6 ppm leachable arsenic. If the right TCLP test were used, the BDAT based on vitrification would have been even higher emphasizing further that vitrification is poor, not best, technology for arsenic. Therefore, EPA should not set vitrification as BDAT for arsenic wastes.

COMMENT NUMBER: 5-K-4
DOCKET NUMBER: LD12-L0034
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Vitrification Not Demonstrated
RESPONSE

The Agency has received two comments indicating the viability of vitrification of arsenic sulfide bearing wastes. Rhone-Poulenc (Comment No. LD12-00207) submitted data from a number of trial runs with vitrification equipment they have developed and potential for use in vitrification of arsenic sulfide bearing sludges from production of phosphoric acid. The data show the vitrified solids additionally meet the treatment standards using the TCLP test.

The Agency notes that TCLP leachate values submitted for vitrified arsenic sulfide-containing wastes were well below the characteristic level indicating that the arsenic had become fixed in the glass matrix. The TCLP test is more rigorous than the EP toxicity test and would be expected to reveal the presence of unreacted arsenic compounds present as discrete phases trapped inside glass matrices. As a result, the Agency does not believe that long-term exposure will lead to leaching of significant amounts of arsenic or arsenic-containing compounds.

Penberthy Electromelt International, Inc. (Comment No. LD12-00266), a manufacturer of electric glass furnaces, has commented that arsenic sulfides can be used in place of the oxide in glass production.

The Agency thus feels that vitrification of arsenic sulfide is viable as a treatment technology.

Comment Number: 5-L-1

Docket Number: LD12-00183

Commenter: Southern Pacific Transportation Company

Issue: Arsenic / Selenium

Subissue: Vitrification technology is not available

Comment:

Vitrification also has not been shown to be "available". The proposed third-third rulemaking states that, to be available, the technology itself or the services of the technology must be able to be purchased or must be commercially available. 54 Fed. Reg. 48,380 (1989); 51 Fed. Reg. 40,589 (1986). EPA also has stated that a technology is available only if a proprietary or patented process can be purchased from the proprietor. 54 Fed. Reg. 41,567 (1989). The proposed rulemaking concedes that there is no available capacity for vitrification. Id. at 48,475. Southern Pacific therefore questions the statement in the Background Document that:

> The Agency has identified one commercial waste vitrification facility and has determined that the vitrification process units are currently available for purchase. Consequently, EPA believes vitrification is available.

Background Document at 4-3. Even if technically available in the sense that the services of Geosafe Corporation can be purchased, the availability of this technology is limited as a practical matter. Batelle-Northwest holds the patents on the vitrification process. Since Geosafe is associated with Batelle, the development of this technology on a competitive basis will be very limited.

COMMENT NUMBER: 5-L-1
DOCKET NUMBER: LD12-00183
COMMENTER: Southern Pacific Transportation Company
ISSUE: Arsenic
SUBISSUE: Vitrification Not Available
RESPONSE

Additional information received by the Agency indicates that in addition to Battelle, the firm cited by the commenter, Rhone-Poulenc (Comment No. LD12-00207) and Penberthy Electromelt, Inc. (Comment No. LD12-00266) also have competitive patents on vitrification technologies. Penberthy has indicated that it commercially sells glass vitrification equipment and Rhone-Poulenc has indicated it is considering commercial treatment using the technology.

Comment Number: 5-L-2
Docket Number: LD12-L0002
Commenter: American Wood Preservers Institute
Issue: Arsenic/Selenium
Subissue: Vitrification technology is not available
Comment:

EPA in its proposal, is specifically soliciting comments and treatment data from industry on whether the proposed treatment standard is achievable for all D007 non-wastewaters. EPA also notes that if comments indicate that the standard is not achievable, the Agency may promulgate a 5.2 mg/l standard-based on a transfer of F006[5]/ treatment standards. AWPI has researched the matter, having contacted representatives of the treatment, storage and disposal (TSD) facilities currently accepting D004 and D007 wood preserving wastes. Although there are indications from bench scale tests that at least the F006 standards for chromium wastes may be achievable, there are no data from wood treaters, chemical suppliers, or treatment and disposal facilities to indicate that the levels proposed by EPA are achievable on a regular basis for typical arsenical and chromium wood preserving wastes.

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[5]/ F006 is defined in 40 CFR 261.31 as "wastewater treatment sludges from electro-plating operations ...."

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Comment Number: 5-L-2 (Cont.)
Docket Number: LD12 - L0002
Commenter: American Wood Preservers Institute
Issue: Arsenic / Selenium
Subissue: Vitrification technology is not available
Comment:

Glass vitrification is an inefficient treatment technology that does not offer sufficient, readily available capacity for the wood preserving industry. Assuming, for example, that the solubility of arsenic in glass is 0.5 percent, 200 tons of glass would be required to solidify a single ton of arsenic.

COMMENT NUMBER: 5-L-2
DOCKET NUMBER: LD12-L0002
COMMENTER: American Wood Preservers Inst.
ISSUE: Arsenic
SUBISSUE: Vitrification is Not Available
RESPONSE

The commenter has restricted his comments to one form of vitrification--glass vitrification. The background document for D004 wastes also showed data for slag vitrification, where up to about 20 weight percent arsenic can be successfully incorporated into a slag matrix. Additionally, one commenter has submitted data indicating a 75 percent volume reduction for land disposal when using vitrification for treatment of D004 nonwastewaters. The regulation for D004 wastes does not specify that a vitrification process must be used to achieve the proposed D004 treatment standards. Facilities are free to use any treatment method or combination of methods to meet the numerical treatment levels. The Agency notes, however, that vitrification may be the simplest technology to use for the management of wastes containing both arsenic and chromium. Both elements will become incorporated into an inert glass matrix.

Comment Number: 5-M-1
Docket Number: LD12 - 00067
Commenter: Hazardous Waste Treatment Council
Issue: Arsenic/ Selenium
Subissue: Stabilization as BDAT for arsenic
Comment:

g. A numerical arsenic nonwastewater BDAT standard based upon stabilization should be promulgated as soon as possible. The proposed vitrification standard should be dropped along with the two-year extension.

COMMENT NUMBER: 5-M-1
DOCKET NUMBER: LD12-00067
COMMENTER: HWTC
ISSUE: AS
SUBISSUE: Stabilization for Arsenic

RESPONSE

The Agency has considered all of the data submitted for both vitrification and stabilization of D004 wastes. Overall, the stabilization data showed that with proprietary treatments at least some wastes could be properly managed with or without chemical pretreatment. On the other hand, the Agency is aware of numerous arsenic stabilization tests that have shown little or no treatment.

The Agency found that both vitrification and some chemical treatment and stabilization processes could treat the widely diverse arsenic wastes to levels below the treatment standard. Vitrification results, however, pointed to a broader applicability. Facilities may use either of the technologies to meet the standards. Capacity issues are discussed in the capacity section of preamble and various capacity support documents.

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Comment Number: 5-M-2
Docket Number: LD12-00183
Commenter: Southern Pacific Transportation Company
Issue: Arsenic / Selenium
Subissue: Stabilization as BDAT for arsenic
Comment:

III. Chemical Fixation Should Be Selected as the BDAT for K031 Wastes and as the Remedial Technology for the Crystal Site Soils

In contrast to in situ vitrification, chemical fixation is demonstrated, applicable, and available for treatment of soils contaminated with K031 wastes.

A. Conceptual Basis of Advanced Chemical Fixation Technology as it Applies to Methanearsonic and Cacodylic Acid

Waste treatment techniques that are composed of Portland cement, fly-ash, cement kiln dust, quick-lime, soil, clay, asphalt, sodium silicate, slag, gypsum, etc., in various combinations for solidification/stabilization (S/S) have been used for a number of years all over the world. Users and suppliers of these technologies have in some cases also used the term chemical fixation (CF) to define various compositions of these materials, possibly with the addition of trace compounds to accentuate their effectiveness with certain waste types. Whatever the terminology used, S/S or CF, particular compositions of these materials are the basis of the proprietary treatment products on the market and are available. One of the major appeals of this class of treatment technology is the relative lower cost, if the treatment is sufficiently effective for the waste types to

Comment Number: 5-M-2 Continued
Docket Number: LD12-00183
Commenter: Southern Pacific Transportation Company
Issue: Arsenic / Selenium
Subissue: Stabilization as BDAT for arsenic
Comment:

which it is applied. S/S has been viewed by many in the environmental field as a physical or civil engineering process instead of a sophisticated chemical system. Tests for the effectiveness of treatment have revolved around certain levels of physical changes in the "ante et post" treatment state. "Successful" treatments of metals, radioactive and non-radioactive, in certain concentrations in sludges, soils, and liquids, as measured by particular light acid and water leach tests, have given additional credence to the notion that this is a viable and effective treatment for a wide range of waste types. The basic chemical function that has made S/S effective in terms of the treatment of metals is complexation or chelation.

A S/S or CF material will or will not be effective in stopping the leaching of a given metal from a treated soil or sediment matrix depending on the particular concentration and type of complexing agents that are available for bonding in its formula and the pH solubility characteristics of the metal in question. Certain complexing agents that work for a given metal contaminant in one waste treatment situation may not work for the same metal in another situation because of chemical interferences in the soil or sediment matrix. Also

Comment Number: 5-M-7 continued
Docket Number: LD12-00183
Commenter: Southern Pacific Transportation Company
Issue: Arsenic / Selenium
Subissue: Stabilization as BDAT for arsenic
Comment:

the effectiveness of complexing agents can be improved or altered with certain hetero or homo nuclear metal clusters and/or pairs. The use of mixtures of cement, fly-ash, lime, kiln dust, etc., in various combinations will usually "work" on certain metals that appear in the cation state in acceptable pH ranges at relatively low concentrations. There are enough naturally occurring complexing agents in these mixtures to tie-up the metals. When one takes a soil that has low concentrations of cation metals that can be successfully treated with a standard mixture and adds a certain level of organic material, the leach values will depreciate because of the interference of the organic material in the matrix. There also is the possibility of inorganic interference as well in which the complexing agents that will work with the metals will also complex with themselves. With the addition to the cement-based CF material, or added independently into the soil, the right complexing agents will affect the performance of the CF material in such a fashion that will quantum jump over a straight pozzolan or cement mixture.

COMMENT NUMBER: 5-M-2
DOCKET NUMBER: LD12-00183
COMMENTER: Southern Pacific Transportation Co.
ISSUE: Arsenic
SUBISSUE: Stabilization as BDAT for Arsenic
RESPONSE

The Agency, at present, has data indicating that stabilization is an unsatisfactory technology for K031 wastes. Stabilization may provide treatment of some chemical types of arsenic wastes. However, in many such cases unique formulations or extensive chemical pretreatments are needed. These pretreatments generally require conversion of the arsenic present to insoluble arsenate salts.

The numerical treatment standards are based on vitrification data, however, facilities are free to use other technologies for compliance. Therefore, the commenter may utilize one or more of the solidification/stabilization or chemical fixation compositions described in the comment.

Comment Number: 5-N-1
Docket Number: LD12-00207
Commenter: Rhone-Poulenc
Issue: Arsenic/Selenium
Subissue: Stabilization Unsatisfactory
Comment:

As EPA is aware, the results of previous arsenic treatment test using a cement based fixation method increased the volume of sludge containing material for disposal and subjects the sludge to a basic pH environment which could increase arsenic solubili as groundwater attacks the disposed solid. This method results in EP Toxicity Tests that meet the arsenic characteristic level of 5.0 mg/l.

COMMENT NUMBER: 5-N-1
DOCKET NUMBER: LD12-00207
COMMENTER: Rhone Poulenc
ISSUE: Arsenic
SUBISSUE: Stabilization Unsatisfactory
RESPONSE

The Agency shares the same concern as Rhone-Poulenc with respect to the use of alkaline stabilization processes for treatment of arsenic bearing wastes. In some instances, data show that stabilization with alkaline binders increases the solubility of some arsenic compounds.

Comment Number: 5-0-1
Docket Number: LD12-00207
Commenter: Rhone-Poulenc
Issue: Arsenic / Selenium
Subissue: Vitrification data supplied
Comment:

Rhone-Poulenc initiated a study of ~~its own to determine if~~ arsenic containing sludges could be fixed in a more permanent manner to provide a decrease in volume as well as a significant lower arsenic solubility level as determined by TCLP Test methods.

This study found that a vitrification process using a specific glass formulation region would produce a significantly better method for the disposal of D004 wastes generated in phosphoric acid purification. The fused inert aggregate glass product decreased the volume for disposal by more that 75% even though fixation and fluxing agents were added. The resultant product, when subjected to TCLP methodology, gave soluble arsenic levels significantly below the 5.0 mg/l level. The table below gives series of glass formulations with results for EP Toxicity or TCI Testing.

Table 1

Vitrification Glass Samples using Arsenic Containing Sludge

Sample Testing Methods (Arsenic)

Sample I.D.	EP Toxicity	TCLP
R-P	Nil	-
5129	0.5 ppm	-
WW2	-	0.8 ppm
WW2, 2	-	1.0 ppm
WW2, 1.5	-	Nil
WW2, 1.0		2.5 ppm (± 0.5 ppm

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Comment Number: 5-0-1continued
Docket Number: LD12-00207
Commenter: Rhone-Poulenc
Issue: Arsenic/Selenium
Subissue: Vitrification data supplied
Comment:

Notes:

1. All samples were crushed to approximately 1/4 inch or less for testing.

2. Method Detection Limit 0.5 ppm As.

This treatment process is the basis for U.S. Patent Number 4,820,325 issued April 11, 1989.

Rhone-Poulenc is now developing the furnace design and auxiliar equipment configuration to achieve an environmentally sound application of this process. To avoid arsenic loss due to vaporization, a special furnace configuration with a recycling vapor scrubbing system is being investigated. Once this configuration is established, a pilot plant testing program wil be required before an operational process testing program will available for industrial use.

COMMENT NUMBER: 5-0-1
DOCKET NUMBER: LD12-00207
COMMENTER: Rhone Poulenc
ISSUE: Arsenic
SUBISSUE: Vitrification Data Supplied
RESPONSE

The Agency appreciates Rhone-Poulenc's data submission showing arsenic sulfide wastes may be vitrified and that vitrification results in a 70 percent reduction in waste volumes. Rhone Poulenc's data also show TCLP leachates from the vitrified material easily meet the Agency's treatment standard for D004 wastes. The Agency supports Rhone Poulenc's decision to use vitrification for D004 waste treatment to meet the concentration-based treatment standard.

The waste treated by Rhone-Poulenc contained 2 to 2.5 percent arsenic and attained a treatment level of 2.5 mg/l arsenic in the TCLP leachate. However, the Agency based the numerical treatment standard on vitrification of a more difficult to treat waste, i.e., one containing over 20 percent arsenic.

Comment Number: 5-0-2
Docket Number: LD12-00133
Commenter: PPG
Issue: Arsenic
Subissue: Vitrification
Comment:

D004/D010 Arsenic/Selenium - PPG's glass manufacturing facilities generate flue slag nonwastewater waste material which can contain various combinations of arsenic, cadmium, chromium, lead and selenium metals. Due to the different chemical characteristics of these metals, vitrification appears to be the only feasible treatment method for stabilizing the mixture of metals in slag wastes. PPG supports the proposed two-year national capacity variance for wastes whic have a prescribed standard based on vitrification. However, PPG is unaware of any existing commercially viable vitrification facilities and is concerned that sufficient vitrification treatment capacity will still not be available at the end of the proposed two-year national variance period.

COMMENT NUMBER: 5-0-2
DOCKET NUMBER: LD12-00183
COMMENTER: PPG
ISSUE: Arsenic
SUBISSUE: Vitrification
RESPONSE

The Agency agrees with PPG's argument that vitrification may be an effective management method for wastes containing EP toxic metals with widely varying chemical properties. EPA also agrees that stabilization may be ineffective for such metal-containing wastes due to different chemical characteristics.

One commenter, Penberthy Electromelt (Comment No. LD12-00266), has indicated that the necessary glass furnaces for vitrification units can be supplied within six months of requisitioning. In addition, a second commenter indicated the firm is considering providing commercial vitrification facilities. Note that since the treatment standards are numerical for arsenic nonwastewaters, facilities may use methods other than vitrification for compliance.

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Comment Number: 5-P-1
Docket Number: LD12-00266
Commenter: Penberthy Electromelt International, Inc.
Issue: Arsenic / Selenium
Subissue: Vitrification supported as BDAT for As/Se
Comment:

Both arsenic and selenium can be incorporated into glass which is inert and insoluble, whereby the arsenic and selenium are sequestered out of the biosphere permanently. Both technology for doing this, called glassification or vitrification, and the furnaces for doing this are commercially available from the writer's company.

COMMENT NUMBER: 5-P-1
DOCKET NUMBER: LD12-00266
COMMENTER: Penberthy Electromelt
ISSUE: Arsenic
SUBISSUE: Vitrification Supported as BDAT
RESPONSE

The Agency thanks Penberthy Electromelt for additional information on incorporation of arsenic and selenium into glasses.

The Agency believes, based on available data, that vitrification is BDAT for arsenic nonwastewaters. However, the Agency has received stabilization data for selenium and has developed treatment standards based on stabilization as BDAT for selenium since it is the only performance data available to the Agency for treatment of selenium nonwastewaters. EPA believes that vitrification is an applicable technology to treat selenium wastes but believes wastes with high selenium concentrations and requiring vitrification to meet the numerical standards are being recovered.

Comment Number: 5-Q-1
Docket Number: LD12-00266
Commenter: Penberthy Electromelt International, Inc.
Issue: Arsenic/Selenium
Subissue: TCLP with glasses can give misleading results
Comment:

Page 48432, col. 3. Note that glasses are better than slags for leaching resistance because glasses do not have any intercrystalline planes into which water can penetrate.

COMMENT NUMBER: 5-Q-1
DOCKET NUMBER: LD12-00266
COMMENTER: Penberthy Electromelt
ISSUE: Arsenic/Selenium
SUBISSUE: TCLP With Glasses

RESPONSE

The Agency does not have any data to substantiate the commenter's claim that glasses are more resistant than slags to leaching. If the commenter has any experimental data to verify this point, they are urged to submit it for the Agency's consideration.

Comment Number: 5-R-1
Docket Number: LD12-00269
Commenter: ASARCO
Issue: Arsenic/Selenium
Subissue: BDAT is technically flawed because it sets
Comment: Standards by element instead of waste type

The EP Toxic Metals BDATs Are Not Only Flawed, But Cannot Be Applied to the Newly Identified Mineral Processing Wastes

1. EPA's Methodology in Developing EP Toxic Metals BDATs is Flawed.

Asarco is concerned that EPA at some future date may transfer the BDATs established for metals to the newly identified mineral processing wastes. However, due to the flaws in EPA's methodology, as well as the inappropriateness of such BDATs to mineral processing wastes, the BDATs established for the EP toxic metals should not be transferred when EPA proposes land disposal restrictions for newly identified and listed hazardous wastes.

EPA does not adhere to its methodology described in the preamble to the proposed rule in determining the BDATs for EP toxic metals. 54 Fed. Reg. at 48380-81. The critical steps in the methodology involve (1) segregating "the wastes into groups based on similar physical and chemical properties" while taking into account "differences in the applicability and effectiveness of treatment for those particular wastes;" (2) identifying alternative techniques that are "demonstrated" and "available;" and (3) screening these technologies based on "treatment data" to identify the best technology.

Comment Number: 5-R-1 continued
Docket Number: LD12-00269
Commenter: ASARCO
Issue: Arsenic/Selenium
Subissue: BDAT is technically flawed because it
Comment: sets standards by element instead of waste type

The Agency's approach in dealing with the effectiveness of the proposed BDATs ignores fundamental physical chemistry by considering treatment with BDAT on a metal by metal basis rather than on a waste by waste basis. This approach does not take into account the interaction of other metals on the effectiveness of the recovery of the metal under consideration. This narrow perspective is particularly significant when dealing with wastewaters. The presence of other metal ions affects the chemical activity of the particular metal being treated, and therefore its solubility. As a result, the extent of a treatment's effectiveness is likely to be influenced by the presence of other metals. Appendix A provides Asarco's views on treatment standards for specific metals in wastewaters.

Asarco appreciates the magnitude of the task to identify BDATs for characteristic hazardous wastes, but EPA's attempt thus far to identify appropriate BDATs has been superficial. Part of the problem is that the Agency has set for itself an artificial deadline that will not allow time for a more thorough analysis. EPA should recognize that, by statute, the "hard hammer" does not apply to characteristic hazardous waste and then embark on a more systematic and reasoned evaluation.

Comment Number: 5-R1 continued
Docket Number: L012-00269
Commenter: ASARCO
Issue: Arsenic / Selenium
Subissue: BDAT is technically flawed because it sets
Comment: standards by element instead
of waste type

The proposed BDATs for metal wastes are based, for the most part, on an evaluation of data that the Agency already possessed for only one or two technologies for treating only one or two wastes. EPA indicated that the major source of waste characterization information is the National Survey of Hazardous Waste Generators ("Generator Survey") and that the results of the survey have been used to develop treatability groups. The Agency also used some waste characterization data from the National Survey of Treatment, Storage, Disposal and Recovery Facilities ("TSDR Survey"). However, EPA has categorized certain unrelated wastes into one treatment group for many of the metals. For example, all arsenic and selenium-containing wastes have been put in a single treatability group. This group included inorganic and organic compounds of arsenic and selenium. Such a grouping does not adequately recognize the differences in physical and chemical properties, as required by EPA's methodology. In addition, a very limited number of treatment technologies seem to have been evaluated in the BDAT determination. For example, treatment standards for D, F, K, U, or P wastes were derived from available performance data on a limited number of F and K listed wastes containing these metals. 54 Fed. Reg. at 48429.

COMMENT NUMBER: 5-R-1
DOCKET NUMBER: LD12-00269
COMMENTER: ASARCO
ISSUE: Arsenic
SUBISSUE: BDAT if Flawed
RESPONSE

The Agency originally grouped arsenic and selenium together because their chemical properties are similar to each other and are very different from the other toxic metals such as silver or cadmium. Arsenic and selenium are soluble in alkaline solutions. The sulfides of these elements can be precipitated at low pH. The sulfides and oxides of selenium and arsenic sublime at low temperature. Prior to proposal for Third Third wastes, the Agency had no treatment data for selenium-containing wastes so treatment performance was transferred from arsenic. During the comment period treatment data were submitted for selenium. As a result arsenic and selenium are in separate treatability groups.

Vitrification has been selected as the BDAT technology for arsenic wastes because it is capable of managing both inorganic and organometallic containing wastes. At the temperatures the process is operated, organometallic compounds are oxidized to simple inorganic oxides which can be vitrified.

Stabilization has now been selected as BDAT for selenium (D010) nonwastewaters because information received by the Agency indicates wastes containing high levels of selenium are normally processed to recover this metal and wastes containing low levels of selenium can be successfully stabilized.

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Comment Number: 5-S-1
Docket Number: LD12-00159
Commenter: Waste Mgmt., Inc. & Chemical Waste Mgmt., Inc.
Issue: Arsenic / Selenium
Subissue: Stabilization as BDAT for As/Se
Comment:

b. Arsenic -- D004 (54 Fed. Reg. at 48,432)

The Agency proposes a performance-based treatment standard for D004 arsenic-containing nonwastewaters of 5.6 mg/l based solely on stabilization by vitrification. Id. This technology was selected as an alternative to chemical stabilization based on the Agency's belief that certain "stabilization data using cement, lime, and other proprietary binder mixtures are inconclusive in demonstrating stabilization of arsenis." The Agency goes on to say that "[a]lthough the amount of leachate arsenic is sometimes reduced, the results are not reproducible and, in some cases, can be attributed to dilution with the binders (high binder to waste ratios)." 54 Fed. Reg. at 48,431. For reasons stated below, WMI believes the Agency's conclusions respecting chemical stabilization of arsenic are partially incorrect.

WMI previously submitted data to the Agency demonstrating that certain arsenic-containing wastes (e.g., As_2S_3 from phosphoric acid purification, and certain organic arsenicals) cannot currently be stabilized to meet the proposed BDAT standards. We continue to believe this to be the case for this particular subcategory of arsenic wastes.

Comment Number: 5-5-1 continued
Docket Number: LD12-00159
Commenter: Waste Mgmt., Inc. and Chemical Waste Mgmt., Inc.
Issue: Arsenic / Selenium
Subissue: Stabilization as BDAT for As/Se
Comment:

With respect to treating other arsenic-containing nonwastewaters, however, we believe that the Agency's proposed treatment level of 5.6 mg/l can be met using chemical stabilization. This is shown graphically in Attachment E. Waste types are spread across the x-axis (the numbers have no meaning -- they were assigned only to differentiate the various wastes tested) and the lowest leaching level achieved by the optimum formulation for each waste is represented by a data point. In some cases, several optimums using different formulations are given. It is apparent from this data that the only failures in respect to the Agency's proposed treatment level are with the arsenic trisulfide-containing phosphoric acid waste. In addition, current treatability studies being conducted by CWM on soils contaminated with organic arsenicals indicate that these wastes also would not meet the proposed requirements, but this work is still in progress and therefore, is not included in the graph.

Further, treatability data developed by this company in support of the above information was generated using the TCLP. WMI is very concerned that the Agency appears to be taking a step backward by relying solely on data generated by the EP-Toxicity protocol for proposing its performance-based standard for arsenic wastes. Id. at 48,432. For example, in its proposed regulations

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Comment Number: 5-S-1 continued
Docket Number: LD12-00159
Commenter: Waste Mgmt., Inc. and Chemical Waste Mgmt., Inc.
Issue: Arsenic/Selenium
Subissue: Stabilization as BDAT for As/Se
Comment:

for First-Third scheduled wastes the Agency rejected the use of EP-Toxicity data when developing treatment standards for K061. 53 Fed. Reg. at 11,752. In respect to using EP-Toxicity data for K061 BDAT development the Agency stated that "[t]hirty-one of the stabilization data values were rejected because those data did not reflect testing by the TCLP procedure; the remaining nine were obtained using the TCLP and represent proper design and operation." Id. Further, we find it inconsistent that the Agency now appears to be shifting the responsibility of demonstrating statistical equivalency between the TCLP and EP tests to treatment facilities. In its August 12, 1987 Notice of Data Availability concerning "California List" wastes the Agency notes that it is "reviewing the TCLP to determine if it produces results for those wastes that approximate those from the EP-toxicity test." 52 Fed. Reg. at 29,992. Apparently this review has not taken place.

We view, as does the Agency, "the continued use of the EP test as a measure of compliance with treatment standards as unfortunate." 54 Fed. Reg. at 48,432. We further believe, however, that the Agency must conduct statistical comparisons between these two tests to settle once and for all whether one or both of these tests should be used.

COMMENT NUMBER: 5-S-1
DOCKET NUMBER: LD12-00159
COMMENTER: Waste Management
ISSUE: Arsenic
SUBISSUE: Stabilization BDAT
RESPONSE

The Agency studied all of the data on vitrification and stabilization treatment of arsenic wastes. The stabilization data available to the Agency showed at least some wastes can be properly treated by that method. However, in the cases where arsenic wastes were successfully stabilized either pretreatment was used to convert the waste to ferric arsenate before stabilization or the stabilization mixtures contained proprietary additives such as ferric salts and oxidants which would convert the arsenic present to ferric arsenate in situ. Stabilization with lime, cement, or other pozzolanic additives alone generally was unsuccessful. In cases where stabilization is successful, the arsenic first needs to be converted to ferric arsenate and then stabilized. An excess of about 4 to 1 iron to arsenic is generally used. Therefore the volume of waste requiring disposal increases sharply. Vitrification appears to have a broader applicability.

The standards for arsenic are based on vitrification, however, it is a numerical standard and stabilization or other technologies may be used solely or in combination to achieve the treatment level. Also note that the standard is 5.0 mg/l arsenic in the TCLP leachate; that is, the Agency is setting a standard based on TCLP, not EP.

The standards for selenium have been revised by the Agency because stabilization data has been submitted by commenters and is based on stabilization technology. A numerical standard has been established for the final rulemaking and facilities may also use other treatment methods for compliance.

COMMENT NUMBER: 5-S-1 (continued)
DOCKET NUMBER: LD12-00159
COMMENTER: Waste Management
ISSUE: Arsenic
SUBISSUE: Stabilization BDAT
RESPONSE

EPA notes, and relies upon, the commenter's statement that not all arsenic wastes can be stabilized to the characteristic level. The Agency agrees. This is why the final standard is based on performance of vitrification, and why EPA has granted a two-year national capacity variance for these wastes.

Comment Number: 5-T-1
Docket Number: LD12-00045
Commenter: Bethlehem Steel Corporation
Issue: Arsenic/Selenium
Subissue: Not treatable, non defined Se waste
Comment:

Bethlehem supports EPA's determination (page 48430) that arsenic and selenium typically exist in aqueous conditions as oxo-anions and do not exhibit the cationic behavior like other metals. However, Bethlehem does not agree that all oxo-anions of selenium and arsenic can be removed by use of the same treatment technology, (i.e., chemical precipitation) identified as BDAT in the proposed rules for all selenium and arsenic species. Bethlehem has performed treatability studies on its WAL and the results show that chemical precipitation technique using ferric chloride, calcium hydroxide, aluminum, ferrous ions and sodium sulfide to remove selenium from WAL is not effective. Attachment 3 provides a summary of the results of these treatability studies.

Therefore, it is clear to Bethlehem that the chemical precipitation technique proposed by EPA as BDAT for removal of selenium in wastewaters will not be effective for WAL wastewaters. Since WAL wastewaters contain a variety of organic and inorganic compounds, Bethlehem believes that a new series of experiments is needed to identify and develop a feasible treatment technology for selenium in such wastewaters. A literature search has shown that in light of the complex selenium chemistry and unknown oxidation state of selenium in WAL, other treatment technologies such as adsorption using a metal hydroxide complex, biological oxidation, incineration and thermal evaporation are potentially viable technologies. Our own studies have shown that biological oxidation following ammonia stripping is an effective technology for removing selenium from WAL.

COMMENT NUMBER: 5-T-1
DOCKET NUMBER: LD12-00045
COMMENTER: Bethlehem Steel
ISSUE: Selenium
SUBISSUE: Non-treatable Waste
RESPONSE

The Agency recognizes that some selenium wastewaters may not be treatable with the chemical precipitating reagents used to develop the treatment standards in the proposed regulations. The Agency proposed a numerical level based on the sulfur dioxide precipitation process. During the comment period, additional information submitted showed that precipitation with sodium sulfide or hydrogen sulfide at pH 2.0 reduces selenium compounds present to insoluble elemental selenium, and that this sulfide treatment is the "best" chemical precipitation process and should provide treatment for most selenium wastewaters. The Agency has promulgated a treatment standard for selenium based on the performance of sulfide precipitation. The Agency notes that the operating pH is extremely important to providing optimum removal conditions. Examination of the commenter's treatment procedure, however, shows reactions were conducted at neutral pH. Reduction of selenite ion normally requires pH values of less than 3.0 to proceed at a rapid rate.

The Agency is promulgating a numerical treatment level for selenium. Therefore, the commenter is free to select whatever treatment or combination of treatments will allow compliance with the standard.

Comment Number: 5-T-2
Docket Number: LD12-L0031
Commenter: Thermal KEM / CyanoKEM
Issue: Arsenic / Selenium
Subissue: Not treatable, non-defined Se waste
Comment:

Bethlehem Steel comments show treatment to a level of as low as 1.4 mg/L, well within EPA's proposed BDAT standard of 5.2 mg/L Bethlehem identified in their comments that they already have settling capability in the form of clarifiers. We believe that adding a soluble ferric salt (i.e., ferric sulfate) in an acidic pretreatment step with agitation (i.e., pH 2 to 3 for about 1 hour) followed by lime neutralization to pH 7 to 8 in a separate reaction tank prior to clarification will treat the selenium to less than 2.0 mg/L which is less than EPA's proposed standard of 5.2 mg/L. This would fulfill the mandate of the LDR program to treat waste to the maximum extent feasible.

We have submitted extensive data and comments on the proposed BDAT for arsenic and selenium wastewaters (see Docket No. 00044). Our company incinerates waste containing arsenic and selenium as minor constituents. The water from the scrubber is treated in an on-site permitted continuous wastewater treatment plant. The permit for this plant limits arsenic and selenium levels in wastewater to less than 1 ppm. To maintain compliance with this limit a strong reducing agent is used during the acidic pretreatment of the wastewater treatment process, to reduce the selenium to the metallic element removable as an insoluble colloid. Further additions of polymer or iron and pH adjustments using conventional treatment technologies result in less than detectable concentrations of selenium in wastewater. This demonstrates that there are practical alternate treatment methods for removal of selenium.

COMMENT NUMBER: 5-T-2
DOCKET NUMBER: LD12-L0031
COMMENTER: ThermalKEM
ISSUE: Selenium
SUBISSUE: Non-treatable Waste
RESPONSE

The Agency thanks ThermalKEM for its comment that selenium can be precipitated in acid solution in elemental form and that D010 wastewaters can be treated to the characteristic level using a series of treatment steps.

Comment Number: 5-T-3
Docket Number: LD12-L0034
Commenter: HWTC
Issue: Arsenic / Selenium
Subissue: Not treatable, non-defined Se waste
Comment:

Bethlehem Steel comments show treatment to a level of as low as 1.4 mg/liter, well within EPA's proposed BDAT standard of 5.2 mg/liter. Bethlehem identified in their comments that they already have settling capability in the form of clarifiers. Adding an equalization tank and a mixing tank would be all that is required to polish the remaining selenium as described below prior to deep well injection, or other form of land disposal.

One of our member companies submitted extensive data comments on the proposed BDAT for arsenic and selenium wastewaters (see Docket No. 00044). This company incinerates waste containing arsenic and selenium as minor constituents. The water from the scrubber is treated in an on-site permitted continuous wastewater treatment plant. The permit for this plant limits arsenic and selenium levels in wastewater to less than 1 ppm. To maintain compliance with this limit a strong reducing agent is used during the acidic pretreatment of the wastewater treatment process, to reduce the selenium to the metallic element an remove it as an insoluble colloid. Further additions of polymer or iron and pH adjustments using conventional treatment technologies result in less than detectable concentrations of selenium in wastewater. This demonstrates that there are practical alternate treatment methods for removal of selenium.

Carbon absorption should also be installed prior to injection of the water, as it contains high levels of phenols, aromatics and naphthalene.

COMMENT NUMBER: 5-T-3
DOCKET NUMBER: LD12-L0034
COMMENTER: Hazardous Waste Treatment Council
ISSUE: Selenium
SUBISSUE: Non-treatable Waste
RESPONSE

The Agency thanks the Hazardous Waste Treatment Council for pointing out that the difficult to treat selenium-containing wastewater generated at the Bethlehem Steel facility may be treated by chemical reduction to below 1 ppm selenium.

Comment Number: 5-U-1
Docket Number: LD12-L0007
Commenter: The Chemical Manufacturers Association
Issue: Arsenic/Selenium
Subissue: Proposed wastewater standard for D004 differs
Comment: between background document and Federal Register Notice

M. The Agency States That Its Proposed Standard for Arsenic in Wastewaters (D004) Is Based Upon the Most Difficult To Treat Wastewater Matrix. However, the Alternate Treatment Standard for Arsenic, Which Is Based on Wastewater Treatment Data Using the Same Technology as Was Used by the Facility From Which the Proposed Standard Is Developed, Is 76 Percent Greater Than That Proposed by EPA.

EPA discusses the database for its calculation of the proposed treatment standard for arsenic-containing hazardous wastewaters in section III.A.5.b.(1)(a) of the preamble. 54 Fed. Reg. at 48,430. The data are from a veterinary pharmaceuticals facility that uses three-stage alkaline precipitation to remove arsenic from its wastewaters. The calculated treatment standard is 0.79 mg/l.

In Table 4-119 of the Background Document for wastewaters containing BDAT list constituents (LD12-S1061), EPA presents a calculated arsenic standard of 1.39 mg/l. This standard is based on alkaline precipitation, followed by filtration. This treatment sequence uses an additional technology (filtration) added to the basic alkaline precipitation step, yet results in a higher treatment standard than that derived by EPA from the pharmaceuticals data. It is thus apparent that EPA has not based the proposed BDAT standard on the most difficult to treat wastewater.

Comment Number: 5-U-1continued
Docket Number: LD12-L0007
Commenter: The Chemical Manufacturers Association
Issue: Arsenic/Selenium
Subissue: Proposed wastewater standard for D004 differs
Comment: between background document and Federal Register Notice

This is an example of the danger of establishing a concentration-based treatment standard for characteristic wastes using a single facility's waste. There is no way to know if the standard can be achieved for a dissimilar waste.

If the Agency persists with concentration-based standards that are below the characteristic level, then it should use the alternate standard based on wastewater treatment data for arsenic, in this case 1.39 mg/l.

COMMENT NUMBER: 5-U-1
DOCKET NUMBER: LD12-L0007
COMMENTER: CMA
ISSUE: Arsenic
SUBISSUE: Standards Inconsistency
RESPONSE

The Agency has received additional data on treatment of D004 wastewaters consisting of data on ferric arsenate precipitation. This data showed treatment levels between 2 and 3 mg/l of arsenic. EPA is setting the treatment standard at the characteristic level for the reasons explained in Section III-D of the preamble. Also, in the process of reevaluating the D004 waste treatment data, EPA discovered an error in the calculation of the promulgated K101 and K102 wastewater standards for metal constituents. The Agency is amending the wastewater standards to correct the error.

Comment Number: 5-V-1
Docket Number: LD12-00039
Commenter: Swidler & Berlin (Allied-Signal, Inc.)
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

I. Hexafluoroarsenate-Containing Wastewaters Cannot be Treated to the Proposed BDAT Treatment Standards by Any Demonstrated Available Technology

Allied operates at least two facilities where much of the product chemistry revolves around fluorine. In those plants, some of the arsenic that is believed to be introduced into various processes as a contaminant in certain raw materials reacts with fluorine, generating the extremely stable ion hexafluoroarsenate ($(AsF_6)^-$). The data and further discussion contained in this submission refers only to one of the Allied facilities at which $(AsF_6)^-$ is present. Various waste streams at this facility are combined and sent to a wastewater treatment/product recovery facility, where lime is added to the wastewaters. A calcium fluoride product is generated and recovered for use. Prior to use, the calcium fluoride is stored in a warehouse, and at no time is it land disposed.[2] In addition to the calcium fluoride, a wastewater is generated by the wastewater treatment/product recovery facility. This wastewater is then sent to a pond for final settling, prior to being discharged through an NPDES outfall. "Land disposal" within the meaning of RCRA takes place when the wastewaters enter the settling pond.

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[2] Moreover, the calcium fluoride product is well below the proposed treatment standard for nonwastewaters. As shown in Attachment 1, the concentration of arsenic in the EP extract is 2.5 mg/l, compared to the EP toxicity characteristic of 5.0 mg/l and compared to the proposed treatment standard of 5.6 mg/l.

Comment Number: 5-V-1 continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin (Allied-Signal, Inc.)
Issue: Arsenic/Selenium
Subissue: Hexafluorarsenate as special case
Comment:

While most of the streams sent to the wastewater treatment/product recovery facility contain some arsenic, the great bulk of the arsenic is contained in a single wastestream. For convenience, and to prevent what happens at the facility from being obscured by superfluous data, we shall present influent data only from that one significant arsenic-containing stream, which we will refer to as "Stream A." Based on five days worth of data, collected in February, 1989,[1] the total concentration of arsenic in Stream A averaged approximately 13 ppm arsenic (making Stream A characteristically hazardous for arsenic, D004), with the total mass of arsenic estimated to be approximately 12.3 pounds per day. The wastewater effluent from the wastewater treatment/product recovery facility averaged approximately 2.2 ppm arsenic, with an estimated total mass of approximately 3.5 pounds per day. Thus, while the lime treatment performed at the wastewater treatment/product recovery facility resulted in a substantial reduction in the concentration of arsenic contained in the wastewaters prior to land disposal, the wastewater effluent did not meet the proposed treatment standard for arsenic wastewaters. That proposed standard is 0.79 mg/l.

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[1] All streams discussed in this submission were sampled by grab samples collected once every two hours, composited daily for analyses by atomic absorption. The atomic absorption testing was conducted in accordance with the requirements of Standard Method 303E.

Comment Number: 5-V-1 continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin (Allied-Signal, Inc.)
Issue: Arsenic / Selenium
Subissue: Hexafluorarsenate as special case
Comment:

To determine the proportion of total arsenic accounted for by $(AsF_6)^-$, both the influent stream (Stream A) and the effluent stream were analyzed with and without acid digestion as part of the sample preparation. According to Standard Method 303E, contained in Standard Methods for the Examination of Water and Wastewater (16th ed., 1985), "[i]t is left to experienced analyst's judgment whether sample digestion is required."

> Waters and wastewaters may contain varying amounts of organic arsenic compounds and inorganic compounds of As(III), [and] As(V) .... To measure total arsenic ... in these samples requires sample digestion to solubilize particulate arsenic ... and to convert any organic arsenic compounds to inorganic arsenic.

Standard Methods (16 ed. 1985), at 165-66. Under the conditions at the Allied facility, the samples would not contain any organic arsenic, and there is very little particulate matter in Stream A. While there is particulate matter in the wastewater effluent, as described in more detail below, the particulates could account for only a relatively insignificant amount of total arsenic compared to that contained in solution in the effluent stream. Under these circumstances, atomic absorption analyses conducted with or without acid digestion of the samples should give approximately equal results. To the extent that significantly different results were obtained with and without acid digestion, the presence of $(AsF_6)^-$ is believed to be responsible.[*]

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[*] The production processes at the Allied facility include fluorine cells, the effluent from which enters Stream A. The highly oxidizing atmosphere in the fluorine cells (where fluorine is obviously available) is the proper atmosphere for formation of AsF_6. In fact, one would not expect that any other forms of arsenic would be present in this atmosphere.

Comment Number: 5-VI continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluorasenate as special case
Comment:

The results of the analyses with and without acid digestion were indeed very different. For Stream A, the results without acid digestion ranged from 5.82 ppm to 19.73 ppm, while the results with acid digestion of split samples ranged from 7.77 ppm to 26.00 ppm. For the five day period as a whole, the average results without acid digestion were 9.716 ppm, compared to 13.134 for split samples subject to acid digestion.

For the effluent stream from the wastewater treatment/product recovery facility, the difference in the results between the samples with and without acid digestion were substantially more marked. The results without acid digestion ranged from 0.039 ppm to 0.494 ppm. The results with acid digestion, however, ranged from 0.79 ppm to 3.97 ppm. For the five day period as a whole, the average results without acid digestion were 0.169 ppm, while the average results with acid digestion were 2.178 ppm.[2]

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[2] As mentioned above, the wastewater effluent from the wastewater treatment/product recovery facility does contain some suspended solids. However, because the wastewater effluent was filtered by the testing laboratory prior to analysis and sample preparation, the suspended solids cannot account for any part of the dramatic difference in measured arsenic between the samples prepared with acid digestion and those not prepared with acid digestion. Moreover, the concentration of total arsenic in the wastewater effluent could not be significantly affected by the arsenic contained in the suspended solids. The concentration of suspended solids in the wastewater typically varies between 200 ppm and 500 ppm. Based on analyses of the calcium fluoride product – which should be identical to the suspended solids contained in the wastewater effluent – the total arsenic content of the suspended solids is approximately 200 ppm. The contribution of the suspended solids to the arsenic contained in the unfiltered wastewater, therefore, would be 500 ppm x 200 ppm, which equals 0.1 ppm. [0.0005 x 0.0002 = 0.0000001]

Comment Number: 5-V-1 continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluorasenate as special case
Comment:

As discussed above, the difference between the results of samples prepared with acid digestion, and those prepared without acid digestion, is accounted for by the presence of $(AsF_6)^-$. Thus, the concentration of $(AsF_6)^-$ in Stream A averages approximately 3.4 ppm, while the concentration of $(AsF_6)^-$ in the wastewater effluent from the wastewater treatment/product recover facility averaged approximately 2.0 ppm. Of more significance, the mass of $(AsF_6)^-$ in Stream A averaged approximately 3.5 pounds per day, while the mass of $(AsF_6)^-$ in the wastewater effluent averaged approximately 3.25 pounds per day.

Thus, practically all of the $(AsF_6)^-$ that went into the wastewater treatment/product recovery facility came out of that facility in the wastewater effluent. That is, the lime treatment of the wastewaters entering the treatment facility was completely ineffective for $(AsF_6)^-$.

Comment Number: 5-V-1 continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluorasenate as special case
Comment:

By contrast, very little of the arsenic not tied up as $(AsF_6)^-$ [hereinafter referred to as "conventional arsenic"] made it through the treatment process, into the wastewater effluent. The concentration of conventional arsenic in Stream A averaged 9.716 ppm, while the concentration of conventional arsenic in the wastewater effluent from the wastewater treatment/product recovery facility averaged only 0.169 ppm. The mass of conventional arsenic was similarly reduced from 8.85 pounds per day to 0.23 pounds per day. This amounts to a reduction in conventional arsenic in excess of 97%.[*]

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[*] The calcium fluoride product generated in the wastewater treatment/product recovery facility presumably contains all of the uncomplexed arsenic removed from the wastewater. Analyses performed on the arsenic content of that product at the same time, however, do not account for all of the removed arsenic. Over the five day period, the average arsenic content of the calcium fluoride product was 4.849 pounds per day, leaving slightly over 4 pounds of arsenic unaccounted for. Some portion of this missing 4 pounds could be accounted for by the fact that the flows on which the mass calculations were based were all estimates, and therefore it is possible that not as much total arsenic entered the treatment/product recovery facility as shown in the figures. It is also possible that analytical difficulties resulted in an under-estimation of the mass of total arsenic contained in the calcium fluoride product.

Comment Number: 5-V-1 continued
Docket Number: LD12-00039
Commenter: Swidler and Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluorasenate as special case
Comment:

These data are summarized in the Table 1, appended to this submission.

Several months of additional data has been collected from the wastewater effluent stream. As with the other data discussed in this submission, grab samples were analyzed by Method 303E, atomic absorption. Again, as with the other data, each sample was split, with one aliquot prepared with acid digestion, and the other prepared without acid digestion.[2] Table 2 includes all the additional data, including several apparent anomalies. For example, the entry for March 29, 1989, shows an arsenic level in the undigested sample at 6.16 ppm, while the arsenic level in the digested sample is at 5.39 ppm. First the level of 6.16 ppm in the undigested sample is an extreme outlier, compared to the overall average for the several month period of 0.297 ppm. Second, it is impossible for the arsenic level in the undigested sample to exceed that in the digested sample. As discussed above, the arsenic detected in the undigested sample should include only the conventional arsenic, while that detected in the digested sample should include all arsenic, whether conventional or in the form of $(AsF_6)^-$. The arsenic level in the digested sample minus the level in the undigested sample should yield the concentration of $(AsF_6)^-$. For the March 29 entry, the apparent level of $(AsF_6)^-$ is negative – an obvious impossibility.

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[2] As with the wastewater effluent samples discussed above, each sample was filtered prior to sample preparation.

Comment Number: S-V-1 continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroasenate as special case
Comment:

Table 3 contains the same data as contained in Table 2, with the few obvious anomalies eliminated. This table shows that the average level of conventional arsenic in the wastewater effluent is only 0.185 ppm, while the total level of arsenic in the wastewater effluent is 2.22 ppm. As shown in the last column of Table 3, over 91% of the total arsenic contained in this effluent consists of $(AsF_6)^-$. The average level of 0.185 ppm of conventional arsenic compares closely with the average level of 0.169 shown in the five day study performed in February. There is every reason to believe, therefore, that the overall removal efficiency for conventional arsenic shown during that five day study (over 97%) has continued over the several month period covered by Table 3.

While the performance data discussed above is for a single stage lime treatment rather than for the three stage treatment system identified in the proposal as BDAT, the use of the three stage treatment system would not materially affect the results. The three stage treatment system identified as BDAT consists of a first stage of lime treatment, followed by manganese sulfate, and finally by a ferric salt, such as ferric sulfate. The three stage treatment system was effective in treating extremely high levels of arsenic, up to 1260 ppm. The levels of total arsenic at the Allied facility are orders of magnitude lower, and do not require three stage treatment.

Comment Number: 5-V-continued
Docket Number: LD12-00039
Commenter: Swidler & Berlin for Allied Signal, Inc
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

The untreatability of the hexafluoroarsenate in the wastewaters would not be affected by the additional stages of treatment employed in the BDAT technology. The lime treatment at the Allied facility is extremely effective in reducing the relatively low levels of treatable arsenic to acceptable levels, averaging approximately 0.2 ppm. While the additional stages of treatment employed in the BDAT technology conceivably could reduce this figure somewhat more, there seems little point in doing so. The problem at the Allied facility is with the $(AsF_6)^-$, and this substance is not amenable to treatment by either manganese or ferric precipitation. The scientific bases for this conclusion are discussed in Attachment 2, "Background Chemistry for Hexafluoroarsenate and Some Considerations for Designing a Facility for its Decomposition in Plant Effluent," by Professor Howell R. Clark. As explained there, and in EPA's Background Document for ... Characteristic Arsenic Wastes (D004) as well,[1/] the basis for all forms of chemical precipitation, whether by lime, manganese, or ferric, is the formation of insoluble arsenate salts. The problem with hexafluoroarsenate, however, is that it does not form insoluble salts. The steps required to break the fluoride bonds, to make the arsenic amenable to treatment, go far beyond what has been identified as BDAT, and moreover those steps are neither "demonstrated" nor "available" as those terms have been interpreted by EPA. Moreover, as discussed in Professor Clark's paper, it is far from clear that there is any advantage from the environmental and human health perspective of undertaking the steps necessary to break the arsenic-fluorine bond.

COMMENT NUMBER: 5-V-1
DOCKET NUMBER: LD12-00039
COMMENTER: Swidler & Berlin (Allied-Signal, Inc.)
ISSUE: Arsenic
SUBISSUE: Hexafluoroarsenate
RESPONSE

The data submitted by the commenter indicate treatment of some arsenic compounds in the D004 wastewaters from 13 mg/l in the untreated wastewater to 2.2 mg/l in the treated wastewater occurred when using chemical precipitation. The Agency agrees with the commenter and believes that there are D004 wastes that have complicated matrices that cannot be treated to the proposed levels. Consequently, the Agency is promulgating a level of 5.0 mg/l arsenic for D004 wastewaters. Based on the data supplied by the commenter, this level should be readily achievable.

Comment Number: 5-V-2
Docket Number: LD12-L0031
Commenter: Thermal KEM / Cyano KEM
Issue: Arsenic / Selenium
Subissue: Hexa fluoroarsenic as special case
Comment:

B. American NuKEM Comments on Allied-Signal, Inc. Comments to Docket F-89-LD12-FFFFF Concerning BDAT Treatment Data for Arsenic and Corrosive Wastes.

I. Hexafluoroarsenate - Containing Wastewaters Cannot be Treated to the Proposed BDAT Treatment Standards by any Demonstrated Available Technology

American NuKEM has experience in treating arsenic containing wastewaters by ferric arsenate precipitation. A detailed data package on this treatment technology was submitted to EPA for consideration as BDAT (see Docket Document #LDR-00044). We have found that this process is far superior to lime precipitation for arsenic removal. We would recommend that Allied Signal, before writing off hexafluoroarsenic as a completely untreatable parameter, try to pretreat the AsF6 stream under acidic conditions prior to adding lime or other alkali for neutralization. The attachment to their comments describing hexafluoroarsenate chemistry also indicates a high probability for this hydrolysis to occur. Elevated temperatures (i.e., 150°F or higher) improve the rate of this reaction. Also, addition of ferric salt under acid conditions (prior to neutralization with lime) will improve the removal of arsenate as it is formed.

In regard to Allied Signal's comments on treatability of hexafluoroarsenate wastewaters, their data supports that these wastewaters can be treated to below the characteristic level. The average for 201 wastewater samples was 2.23 PPM versus the characteristic limit of 5 PPM. They argue that the BDAT standard cannot be achieved, even though they obtain acknowledgment from two commercial treatment facilities that this waste can be treated. They request a case-by-case extension to continue deep well injection of their wastewater merely on the basis that treatment is more costly than deep well injection.

Comment Number: 5-V-2 continued
Docket Number: LD12-L0031
Commenter: Thermal KEM / CyanoKEM
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as a special case
Comment:

Contrary to what was implied in their comments, CyanoKEM is able to treat this waste to the proposed BDAT treatment standards, even lower as demonstrated by our data package submitted to the RCRA docket.

CyanoKEM has developed and tested a treatment protocol to meet these requirements and is ready to implement it on commercial scale.

CyanoKEM agrees that the treatment cost is high. However, treatment cost should not be a consideration, especially when BDAT can be met and an unacceptable disposal method such as deep well injection can be replaced.

Also CyanoKEM's current treatment price is based on implementing a new protocol within existing facilities and equipment. The treatment requires expansion of other operations and dedication of a portion of the plant to arsenic treatment. There is no other feasible way currently available to perform initial waste treatments. However, we expect that business volumes should justify plant expansions to allow arsenic treatment to be conducted in parallel with other operations. This coupled with working experience should tend to lower treatment costs.

We object to these comments for two reasons; first, cost is not a factor in determining if a case-by-case extension is warranted. Secondly, Allied Signal has not exhausted all treatment options. Lime addition is not effective in treating arsenic waste, treatment must be based on ferric arsenate precipitation.

COMMENT NUMBER: 5-V-2
DOCKET NUMBER: LD12-L0031
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Hexafluoroarsenate
RESPONSE

The Agency has contacted Allied Signal to gain further information. Allied Signal has indicated they already have ion chromatography data confirming the presence of hexafluoroarsenates. Hexafluoroarsenates do not form highly insoluble iron or calcium salts and need to be converted to simple arsenates before they can be precipitated as ferric arsenate. The conversion of hexafluoroarsenate to arsenate appear to be problematic based on Allied Signal's experience.

At this point in time, this discussion is somewhat moot, since both commenters indicate that they can treat their wastes below 5 mg/l, the promulgated treatment level.

Comment Number: 5-V-3
Docket Number: LD12-L0034
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

2. Hexaflouroarsenate Waste

In regard to Allied Signal's comments on treatability of hexaflouroarsenate wastewaters, their data supports that these wastewaters can be treated to below the characteristic level. The average for 201 wastewater samples was 2.23 PPM versus the characteristic limit of 5 PPM. They argue that the BDAT standard cannot be achieved, even though they obtained acknowledgement from two commercial treatment facilities that this waste can be treated (i.e., SCA Newark, CyanoKEM in Detroit). They request a case-by-case extension to continue deep well injection of their wastewater merely on the basis that treatment is more costly than deep well injection.

The HWTC objects to these comments for two reasons; first, cost is not a factor in determining if a case-by-case extension is warranted. Pursuant to a settlement agreement in the solvent/dioxin litigation HWTC v. EPA, No. 86-1677 ("HWTC III") (Settlement signed 3/21/89), the Agency has published its view on the use of economic factors in case-by-case determinations. Specifically in the Correction Notice to the First Thirds published on September 6, 1989, (54 Fed. Reg. 36967) EPA stated that cost alone is not a factor in determining if treatment is practical and feasible. The more important factor is technical feasibility of the treatment. Secondly, Allied Signal has not even attempted the use of the most cursory of treatment methods let alone exhausted all treatment options. Lime addition is not effective in treating arsenic waste, treatment must be based on ferric arsenate precipitation.

We would recommend that Allied Signal, before writing off hexaflouroarsenate as a completely untreatable parameter, or merely attempting to rationalize continued deepwell disposal, should try to pretreat the AsF_6 stream under acidic conditions prior to adding lime or other alkali for neutralization. A pretreatment step using sulfuric or nitric acid at pH 2 to 3 for 1 to 2 hours retention with vigorous agitation should effect hydrolysis of 3 or 4 ppm of AsF_6 and convert a significant proportion to free arsenate. The attachment to their comments describing hexaflouroarsenate chemistry also indicates a high probability for this hydrolysis to occur. Elevated temperatures (i.e., 150 degrees F or higher) improve the rate of this reaction. Also, addition of ferric salt under acid conditions (prior to neutralization with lime) will improve the removal of arsenate as it is formed.

COMMENT NUMBER: 5-V-3
DOCKET NUMBER: LD12-L0034
COMMENTER: HWTC
ISSUE: AS
SUBISSUE: Hexafluoroarsenate
RESPONSE

The Agency contacted Allied Signal for further information of the treatment of hexafluoroarsenates. Allied Signal has ion chromatography data confirming the presence of these compounds in their D004 wastewaters. Consultants to Allied Signal have stated that hexafluoroarsenate hydrolysis requires high temperatures and strongly acid conditions (i.e., below 1.0 pH units) to proceed at a measurable rate.

Allied Signal's data indicate, however, that treatment to below the characteristic level is still being achieved (i.e., average of 2.2 mg/l of arsenic in wastewater). In that regard, we agree with the commenter that Allied Signal can treat their wastes to meet the promulgated standard of 5.0 mg/l arsenic for wastewaters.

1

Comment Number: 5-V-4
Docket Number: LD12-L0036
Commenter: Swidler & Berlin
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

Allied-Signal Inc. ("Allied") submitted substantial data on the treatability of arsenic contained in various wastestreams at one of Allied's facilities. That data show that approximately one-third of the total arsenic contained in waste streams sent to a wastewater treatment/product recovery plant is contained in hexafluoroarsenate species, and that the hexafluoroarsenate is not amenable to chemical precipitation. The data confirm that virtually none of the hexafluoroarsenate contained in the influent to the wastewater treatment/product recovery plant is removed, so that the wastewater effluent from that plant contains the same amount of hexafluoroarsenate as contained in the influent, while the removal of other forms of arsenic contained in the influent to the plant is approximately 97%.

There are no data in any of the other submissions that in any way address hexafluoroarsenate, and there is no basis for concluding that hexafluoroarsenate would be treatable under any of the alternative technologies discussed in the submissions. Allied's submission demonstrated that hexafluoroarsenate is not amenable to the same kind of treatments that generally are effective in the treatment of arsenic. To the extent the submissions contain a description of the chemical mechanisms underlying the proposed treatment technologies, it is possible to evaluate the potential applicability of the technology to the treatment of hexafluoroarsenate. In sum, those treatment technologies that are explained are not applicable to hexafluoroarsenate. Those treatment technologies that are not explained cannot be fully evaluated, but those technologies too appear to be inapplicable to hexafluoroarsenate.

2

Comment Number: 5-V-4 continued
Docket Number: LD12-L0026
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

In effect, Allied has demonstrated that the hexafluoroarsenate waste at its Metropolis Works is in a distinct treatability group from other D004 wastes. As noted in the preamble to the proposed Third Third rule, the first step in the development of treatment standards is to divide the wastes into treatability groups, based on similar physical and chemical properties, taking into account differences in the applicability and effectiveness of treatment for those particular wastes. 54 Fed.Reg. 48380. If anything, the submissions of the other parties providing data on arsenic suggest possible BDAT treatment technologies for D004 wastes in treatability groups (wastewaters and nonwastewaters) that do not include hexafluoroarsenate. The suggested technologies might be BDAT treatments for these other arsenic wastes, but none of them would be BDAT for hexafluoroarsenate.

Comment Number: 5-V-4 continued
Docket Number: LD12-L0036
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

To be a BDAT treatment for a specific treatability group, the technology must be "demonstrated" and "available." To be "demonstrated", a technology must be shown to be effective based on data from full-scale treatment operations that are currently being used to treat the waste or a similar waste. To be "available," the technology itself or the services of the technology must be able to be purchased. 54 Fed.Reg. 48380. Moreover, the technology must substantially diminish the toxicity of the waste or reduce the likelihood of migration of the waste's hazardous constituents.[1] Id. By these standards, the proposed treatment technologies are not BDAT for hexafluoroarsenate.

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[1] The extreme stability of the hexafluoroarsenate ion makes it far less toxic than most other forms of arsenic. The arsenic is simply unavailable to yield toxicity, even under the acid conditions that exist within the human stomach. It is far from clear that any treatment of hexafluoroarsenate that would break the arsenic - fluorine bonds so that an insoluble arsenate species could be generated or some other form amenable to the kinds of treatments suggested in the submissions would yield any decrease in toxicity. Quite the opposite is possible.

Comment Number: 5-V-4 continued
Docket Number: LD12- L0036
Commenter: Swidler & Berlin
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

We now turn to discuss each suggested technology and the data submitted in support of that technology separately.

1. Submission of Hazardous Waste Treatment Council, dated December 21, 1989 [LD12-00050]

This submission contains data showing that a proprietary stabilization technique can adequately treat arsenic nonwastewaters. Because the process is proprietary, the applicability of the technique to the Metropolis wastes cannot be determined definitively.[2] There is absolutely no basis for believing that the proprietary stabilization agents described in this submission would be successful in treating hexafluoroarsenate.

According to the submission, this stabilization technology was demonstrated for the following wastes: 1) petroleum refinery waste; 2) boiler stack residue from demolition of stacks and site closure of an electric utility; and 3) electronic equipment manufacturing waste acids from cleaning and plating of metal parts. Submission LD12-00050 at Table I. It is extremely unlikely that any of these wastes would include hexafluoroarsenate.

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[2] Stabilization is a treatment technology that could depend on a complex set of hydrolysis reactions in order to convert the subject material to an insoluble form, and as discussed in Professor Howell R. Clark's paper included with Allied's BDAT treatment data submission as Attachment 2, hexafluoroarsenate is extremely stable, requiring "highly energetic reaction conditions" to lead to hydrolysis. Indeed, temperatures in the vicinity of 600°F and the presence of a very strong acid are necessary to provide those "highly energetic reaction conditions" necessary for hydrolysis. Moreover, under those conditions, hydrogen fluoride gas would be generated.

Comment Number: 5-V-4 continued
Docket Number: L012-L0036
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

There is absolutely no evidence, then, that this proprietary stabilization technology would be effective with respect to hexafluoroarsenate. This technology has not been "demonstrated" with respect to the treatability group in which hexafluoroarsenate belongs. Further, there is not enough information contained in this submission on which to base a conclusion that this technology is even "available." It is not at all clear that this proprietary technology or the services of the technology can be purchased for hexafluoroarsenate, whether or not the technology would be effective. Given the fact that the conditions necessary for hydrolysis will result in the generation of hydrogen fluoride gas, it is at least highly unlikely that any commercial stabilization facility would be willing to accept hexafluoroarsenate for treatment. The extreme corrosivity of HF, and its ability to attack glass and other siliceous materials would make such facilities unwilling to accept a material that would generate HF during treatment.

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Comment Number: 5-V-4 continued
Docket Number: LD12-L0036
Commenter: Swidler & Berlin
Issue: Arsenic/ Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

2. Submission of Hazardous Waste Treatment Council, dated December 28, 1989 [LD12-00067]

This submission is a supplement to the submission discussed above.[1] It provides data indicating that the proprietary stabilization technology is effective even when the pH is raised to 10.5. The preamble to the proposed Third Third rule had suggested that the leachability of arsenic would increase under alkaline conditions. No additional information is presented in this submission, and therefore there is nothing in this submission that suggests that the proprietary stabilization technology has any applicability to hexafluoroarsenate.

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[1] The submission itself states that it is a supplement to the submission of December 26, 1989. This appears to be incorrect. On that date, the Hazardous Waste Treatment Council made a different submission, presenting treatment data on behalf of one of its members, ThermalKem/CyanoKem. The submission made on December 28 certainly is not a supplement to the ThermalKem/CyanoKem submission, which deals with an entirely different type of treatment technology.

Comment Number: 5-V-4 continued
Docket Number: LD12 - L0036
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

3. Submission of Solidiwaste Technology, dated December 19, 1989

This submission presents the results of a solidification technology for arsenic nonwastewaters, which is not otherwise described. Moreover, the cover letter states that the company has been working on the technology over the past four years, and that only within the past two months has the company been able to successfully treat arsenic nonwastewaters to a TCLP level below 5 mg/l. The cover letter goes on to state that "over the next 120 days we will be treating and testing on a weekly basis." Clearly, then, this technology is still in an experimental stage.

Since the process is not described, it is impossible to tell whether it could be applicable to the Metropolis wastes. While this technology might develop into a viable and preferable alternative to vitrification, it clearly is not currently "available," and thus presents no basis for eliminating the proposed national capacity variance.

Comment Number: 5-V-4 continued
Docket Number: LD12-L0036
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

4. Submission of Chemfix, dated December 27, 1989 [LD12-00073]

The Chemset/Chemfix treatment process also appears to be a proprietary stabilization process for arsenic nonwastewaters. The data provided in this submission are quite confusing, but it appears that the Chemfix process is capable of stabilizing "at least some arsenic contaminated streams." Submission LD12-00073 at p. 1.

There is no basis for believing that the arsenic wastes treated by the Chemfix process and reported on in this submission included any hexafluoroarsenate.

For all the reasons discussed in connection with the Submission of Hazardous Waste Treatment Council, dated December 21, 1989 [LD12-00050], the Chemfix technology is neither "demonstrated" or "available" for hexafluoroarsenate.

5. Submission of ThermalKem/CyanoKem, dated December 21, 1989 [LD12-00044][1]

The treatment described in this submission relies on oxidation (either by incineration or by chemical action), followed by chemical precipitation. As described, this treatment technology is applicable to both wastewaters and nonwastewaters. Based on the detailed discussion of this treatment method contained in the submission, Allied concludes that the method is inapplicable to hexafluoroarsenate.

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[1] This submission is identical to the submission of the Hazardous Waste Treatment Council, dated December 26, 1989 [LD12-00059].

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Comment Number: 5-V-4 continued
Docket Number: LD12-L0036
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

This is most clearly shown by examining the discussion of a system for the batch removal of arsenic from soluble salts,[3] at pages 13-14 of the submission. This discussion is most pertinent because, as discussed in Allied's submission, the hexafluoroarsenate enters the wastewater treatment system at Metropolis through a wastestream of a highly soluble inorganic salt, potassium bifluoride. The waste discussed in the ThermalKem/CyanoKem submission, aluminum chloride containing about 1200 ppm arsenic, is dissolved in an agitated tank containing permanganate solution raised to pH 6 to 9.

> The permanganate immediately oxidizes any unoxidized arsenic to prevent arsine gas that may occur under reducing conditions in acid solutions.
>
> The next step of the process consists of lowering the pH of the reaction batch mixture to 2 to 3 with acid (H_2SO_4) when the aluminum chloride is completely dissolved and any arsenic present has been oxidized to arsenate ion.

Because the hexafluoroarsenate is already fully oxidized, it cannot be further oxidized chemically or by incineration, unless the arsenic-fluorine bonds are first broken by hydrolysis. As made very clear in Professor Clark's paper attached to Allied's data submission, breaking the arsenic-fluorine bonds of the hexafluoroarsenate will occur

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[3] The particular salt discussed is aluminum chloride.

Comment Number: 5-V-4 continued
Docket Number: LD12-L0036
Commenter: Swidler & Berlin
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

only under the most extreme of conditions – at a temperature of approximately 600°F in the presence of a strong acid. Permanganate will not "immediately oxidize[] any unoxidized arsenic" and H_2SO_4 without extremely high heat will not oxidize hexafluoroarsenate to the arsenate form. The effectiveness of the ThermalKem/CyanoKem process depends on the oxidation of the arsenic waste, and this oxidation will not occur with hexafluoroarsenate.

Moreover, even if the conditions necessary for the breaking of the arsenic - fluorine bonds could be created, to allow the oxidization of this material, hydrogen fluoride would be generated.[*/] This would create enormous difficulties, given the extremely corrosive nature of this substance. In fact, it seems most likely that ThermalKem/CyanoKem would not accept this waste from the Metropolis Works. As indicated in Table B-1 of the ThermalKem/CyanoKem submission, U134 - Hydrogen Fluoride is not accepted by the facility.

* * * * * * *

Whatever the merits of these various technologies for most forms of arsenic, there simply are no data supporting the use of any of these technologies as BDAT for the hexafluoroarsenate generated at the Metropolis Works.

COMMENT NUMBER: 5-V-4

DOCKET NUMBER: LD12-L0036

COMMENTER: Swidler and Berlin (Allied-Signal)

ISSUE: Arsenic

SUBISSUE: Hexafluoroarsenate

RESPONSE

The Agency thanks Allied Signal for the additional data provided on attempted treatments of hexafluoroarsenates. The Agency has reviewed all of the treatment data for D004 wastewaters and has revised the treatment standards for D004 wastewaters to 5.0 mg/l arsenic. The commenter notes that there are no data available that specifically demonstrate treatment of AsF_6. The Agency believes that the final rulemaking concentration-based standard can be met by all arsenic-containing wastes. However, if AsF_6 cannot be treated to 5.0 mg/l, then the treater can petition for a variance from the standard. Using treatment data for AsF_6, the Agency can then establish a separate treatability group and treatment standard.

Comment Number: 5-V-5
Docket Number: LD12-L0046.
Commenter: Thermal KEM
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

CONCLUSIONS

The mass balance relationships for arsenic presented by Allied-Signal, Inc. for the untreated "Stream A" vs. treated wastewater stream do not prove without doubt that the residual arsenic after lime treatment is due only to a treatment defiant species described as AsF_6^-. A more detailed approach to analyzing arsenic in the untreated wastewater is necessary to show which arsenic form(s) are responsible for the difference in digested vs. undigested arsenic analyses.

Even if AsF_6^- anion does represent a significant portion of the treated effluent residual arsenic, lime treatment alone is not sufficient to ensure effective removal of the more toxic "conventional" arsenic to levels reasonably protective of the environment during deep well injection.

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Comment Number: 5-V-5 continued
Docket Number: LD12-L0046
Commenter: Thermal KEM
Issue: Arsenic/Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

Allied-Signal's data does not conclusively demonstrate that conventional precipitation of arsenic as ferric arsenate, by procedures described in ThermalKEM/CyanoKEM's data Submittal (LD12-000[illegible]) will not be more effective in overall arsenic removal than their present lime treatment process.

Although their submittals show that ferric salts were tested in dosages up to 1000 ppm in their wastewater stream A, no information is shown describing pre-oxidation of the wastewater or the pH value of the reaction mixture during ferric salt addition. These conditions are critical to obtaining effective arsenic removal.

In addition, neither their recent submittal of 2/20/90 (LD12-L0036) nor their previous submittal of 1/8/90 proves that the residual arsenic in the treated wastewater is due primarily to "untreatable" hexafluoroarsenate (AsF_6^-). Specifically, the following two key points in their argument remain unsubstantiated:

A. That the difference in arsenic concentrations determined between undigested and acid digested samples, using Method 303E of "Standard Methods," is actually due to hexafluoroarsenate.

B. That treatment of wastewater "Stream A" by properly administered acid hydrolysis/oxidation and ferric salt precipitation would not be substantially more effective than lime treatment.

COMMENT NUMBER: 5-V-5
DOCKET NUMBER: LD12-L0046
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Hexafluoroarsenate
RESPONSE

The data supplied to the Agency by Allied Signal show reduction of arsenic from 13 mg/l to 2.2 mg/l upon lime treatment. These reductions show treatment for arsenic other than hexafluoroarsenate. Indeed, lime is used as the first step in the complex wastewater treatment system for management of arsenic-containing wastewaters at a veterinary pharmaceuticals plant. The wastewater at that facility is then further treated with manganese and iron salts to remove the remainder of the arsenic. Thus, the Agency feels that lime addition may be an appropriate first step in the treatment of at least some D004 wastewaters.

The Agency presently has no information indicating that chemical precipitation is effective for treatment of hexafluoroarsenates. Additional information appended to Allied Signal's comment (Comment No. LD12-00039) show that decomposition of hexafluoroarsenate ion is a necessary first step for complete treatment. This decomposition occurs only under extremely acid conditions.

The numerical treatment standard for D004 wastewaters is 5.0 mg/l and the facility should be able to comply with this numerical value. If the facility is unable to meet this value, it will have to petition for a variance and submit additional supporting data.

Comment Number: 5-V-6
Docket Number: L012-~~86~~ L0046
Commenter: Thermal KEM
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

A More ~~Detailed Analysis of the Raw~~ Wastewater is Necessary

Method 303E specifies the acid digestion procedures for wastewater samples that are required to convert "inorganic and organic compounds and standards" to As(V) in order to solubilize these species prior to reducing the arsenic to arsine (As(III)) in which form it is most effectively detected by hydride generation atomic absorbtion analysis. Hexafluoroarsenate ion is described in Allied-Signal's submittal to already be in the pentavalent state (i.e., As(V) and therefore, since it is dissolved, should be detected by this procedure without digestion.

However, in order to fully evaluate this conclusion, one must question whether or not the subsequent procedure of reducing the As(V) (if present as AsF_6^-) to As(III) will occur by reaction with sodium iodate. This question can be answered by performing the arsenic analyses by atomic absorbtion equipped with graphite furnace or by ICP analysis which will not depend on the oxidation state of the arsenic ion.

Comment Number: 5-V-6 (continued)
Docket Number: LD12-L0046
Commenter: ThermalKEM
Issue: Arsenic / Selenium
Subissue: Hexafluoroarsenate as special case
Comment:

This leads to another question of how much of the total arsenic showing up only after digestion is due to insoluble arsenic in the raw wastewater sample? Although Allied-Signal claims "there is very little particulate matter in Stream A", it may not take very much particulate matter to account for several ppm of suspended arsenic. Considering that even drinking water from a municipal water supply system can contain 5 to 10 ppm, or more, total suspended solids, and still appear clear or to contain no particulates by visual determinations, the conclusion that particulates in the raw sample do not account for significant amounts of arsenic is unsupported by the submitted data. The ratio of arsenic in the treated effluent suspended solids (assumed to be the same as that in the sludge) cannot be assumed to be the same in the untreated wastewater. Therefore, a more accurate analysis of the nature of the arsenic (including the suspended solids) in the raw wastewater (Stream A) can be made only if the following information is provided:

1. Analysis of untreated samples performed on laboratory filtrates (i.e., 0.45 micron) as well as non-filtered samples for total arsenic to quantify how much, if any, arsenic is suspended.

2. Analysis of total organic carbon in the untreated waste to establish that organics are in fact not present and therefore not responsible for the differences in digested vs. undigested arsenic analyses.

3. Complete quality assurance data showing sample spike recoveries for organic and inorganic arsenic.

4. Analysis of arsenic by alternate detection methods, such as graphite furnace AA, or ICP, that do not depend on hydride generation (i.e., arsine formation) of the arsenic present.

COMMENT NUMBER: 5-V-6
DOCKET NUMBER: LD12-L0046
COMMENTER: ThermalKEM
ISSUE: Arsenic
SUBISSUE: Hexafluoroarsenate
RESPONSE

The Agency agrees with the commenter. The Agency reiterates its statement that Allied Signal deduced the presence of hexafluoroarsenate from wastewater analyses using standard methods.

Allied Signal has since indicated that they presently have ion chromatography data indicating the presence of hexafluoroarsenates.

Comment Number: 5-X-1
Docket Number: LD12-00143
Commenter: General Motors Corporation
Issue: Arsenic/Selenium
Subissue: Levels at/above/below characteristic EP level (many)
Comment:

Proposed Treatment Standards for Arsenic and Selenium

Based on our above comments, GM recommends that the treatment standards for arsenic and selenium for both D004 and D010 wastewaters and nonwastewaters be set at the existing characteristic levels (arsenic at 5.0 mg/l and selenium at 1.0 mg/l) as measured in the leachate generated in the EP Toxicity test. We cannot agree with establishing a standard merely on the basis of it being technically achievable, without any regard to whether it is economically feasible or necessary to fulfill the primary objective of RCRA, the protection of public health and the environment. "Treatment for treatment's sake" should not be required.

COMMENT NUMBER: 5-X-1
DOCKET NUMBER: LD12-00143
COMMENTER: General Motors Corp.
ISSUE: Arsenic
SUBISSUE: Standards
RESPONSE

The Agency has reviewed all of the data submitted by commenters. For wastewaters, the Agency has revised the treatment standards for D004 and D010 and set the new treatment standards at 5.0 mg/l arsenic and 1.0 mg/l for selenium, respectively. The treatment standard for D010 non-wastewaters has been revised due to receipt of additional treatment data on selenium.

The HSWA (1984) legislation required the Agency to develop treatment standards that substantially reduce waste toxicity and mobility so as to minimize threats (HWTC III, 886 F. 2d at 362 (D.C. Cir. 1989)). The cost of treatment is not to be considered in the evaluation.

Comment Number: 5-Y-1
Docket Number: LD12-00172
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Permitting vitrification devices
Comment:

f. Vitrification Devices Are Not Approved As Industrial Furnaces Under 40 CFR 260.10

In the background document for arsenic BDAT (Docket Document No. LD12-S1030), EPA states that for organo-arsenic and organo-selenium waste, the high temperatures of vitrification will destroy the organic hazardous constituents in waste codes such as P036, P038, K031, K084, K101 and K102. Yet it is not clear how EPA intends to permit these devices. These devices are not industrial furnaces since they do not appear on the list specified under 40 CFR 260.10. This means that vitrification devices will have to be permitted as incinerators, since by definition in the background document EPA is relying upon these devices to destroy by high temperature the organic hazardous constituents in the waste. This would mean that these devices would be subject to full Subpart O requirements, including trial burn testing. This also means that the metal strategy for regulating metals emissions from incinerators will have to be applied, limiting waste feed rate consistent with the risk requirement for arsenic. When this is done EPA may find that arsenic feed must be limited to the vitrification devices to levels in the untreated waste below 1000 PPM, in order to meet the cancer risk standard for emissions of 1×10^{-5}. At any rate, the difficult permitting process for incinerators will delay extensively the available vitrification technology.

Comment Number: 5-Y-1 continued
Docket Number: LD12-00172.
Commenter: HWTC
Issue: Arsenic/Selenium
Subissue: Permitting vitrification devices
Comment:

Even with a two-year variance, not enough vitrification technology will become available since the permitting process under Subpart O is excessively long. Therefore, EPA will be faced with an excessive number of case-by-case variance requests in 1992 if vitrification is selected. As noted above, however, if incineration followed by scrubber water treatment is selected, no variance will be needed.

COMMENT NUMBER: 5-Y-1
DOCKET NUMBER: LD12-00172
COMMENTER: HWTC
ISSUE: Arsenic
SUBISSUE: Permitting Vitrification Units
RESPONSE

Vitrification units do not use direct flame combustion and hence do not fall within the definition of incinerators. The Agency intends to permit vitrification units under subpart X regulations and such units will have to meet designated air permit requirements for arsenic and other air emissions.

Comment Number: 5-Z-1
Docket Number: LD12-00116
Commenter: Monsato Company
Issue: Arsenic/Selenium
Subissue: Agency should not specify precipitation method for As WW
Comment:

D004 - Arsenic Containing Characteristic Wastes

The Agency solicited comment on whether it should specify the use of sulfide as the precipitating reagent for all wastewaters containing arsenic as part of the treatment standard. Monsanto believes that the Agency should not specify which reagent should be used to precipitate arsenic/selenium from wastewaters. The Agency appropriately recognizes the uniqueness of arsenic and selenium chemistry as compared to other metals. The chemistry matrix of each wastewater is also unique and therefore each wastewater should be evaluated individually to determine the appropriate reagent for removing arsenic and selenium. Requiring one reagent over another may unnecessarily require subsequent treatment of the wastewater before it can be discharged. It may also preclude the use of non-sulfide treatment processes which generate a precipitate which can be recycled instead of being disposed of.

Monsanto encourages the Agency to set BDAT for arsenic and selenium in wastewater as a treatment standard without specifying a particular reagent.

COMMENT NUMBER: 5-Z-1
DOCKET NUMBER: LD12-00116
COMMENTER: Monsanto
ISSUE: Arsenic
SUBISSUE: Specification of Treatment Agents
RESPONSE

The Agency agrees with the commenter and has not mandated the use of any specific chemical precipitation method to meet the proposed standards for arsenic or selenium wastewaters. Facilities are free to use any method, precipitation or otherwise, or combination of methods to achieve the proposed standards.

Comment Number: 5-2-7
Docket Number: LD12-L0043
Commenter: Fermenta
Issue: Arsenic / Selenium
Subissue: Agency should not specify precipitation
Comment: method for ASWW

Fermenta concurs with EPA that ferric arsenate coprecipitates appear to produce the most stable sludges. Fermenta presented data to EPA on January 8, 1990 that demonstrates the effectiveness of ferric chloride sludges in binding arsenic.

COMMENT NUMBER: 5-Z-2
DOCKET NUMBER: LD12-L0043
COMMENTER: Fermenta
ISSUE: Arsenic
SUBISSUE: Precipitation Agents
RESPONSE

The Agency thanks the commenter for its treatment data and concurs that ferric precipitation is the best method for removal of arsenates from wastewaters. The Agency notes, however, that other arsenic species, such as arsenites or organoarsenic compounds, should first be converted to arsenates prior to precipitation as ferric arsenate.

Comment Number: 5-AA-1
Docket Number: LD12-00081
Commenter: Envirosafe Management Services, Inc.
Issue: Arsenic/Selenium
Subissue: Segregation of arsenic wastes in landfills
Comment:

Page 48430, 1st Col.

EPA is proposing the segregation of arsenic and selenium compounds To date, no adverse effects have been seen in any of the monitorin data generated by the land disposal facilities to justify this. There is no evidence of problems in any of the leachates in Sub-Title C facilities. If there were problems with co-mingling of the materials, a Sub-Title C facility is a much improved management facility versus a Sub-Title D landfill. Therefore, if EPA believes that segregation of these materials is critical, then it should force all disposal of any of these arsenic and selenium wastes in Sub-Title C facilities rather than Sub-Title D facilities.

COMMENT NUMBER: 5-AA-1
DOCKET NUMBER: LD12-00081
COMMENTER: Envirosafe Mgt. Svcs.
ISSUE: Arsenic
SUBISSUE: Waste Segregation
RESPONSE

The Agency considered requiring separate disposal of arsenic and selenium bearing wastes in landfills because of the enhanced solubilities of arsenate and selenate salts in strongly alkaline media. Unlike most EP toxic metals, salts of these two elements tend to be more soluble in alkaline than in acid solutions. In many landfills lime and other alkaline substances are added to maintain the pH above 7.0. This will retard the leachability of chromium and other metals but help to solubilize arsenate salts. For this reason, the Agency considered separate disposal of these materials. Presently, however, the Agency is not mandating separate disposal.

The Agency would appreciate any data that the commenter has on concentrations of arsenic and selenium in Subtitle C landfills, as indicated by the comment.

Comment Number: 5-AA-2
Docket Number: LD12-00013
Commenter: Michigan Disposal, Inc.
Issue: Arsenic/ Selenium
Subissue: Segregation of arsenic wastes in landfills
Comment:

D004 Arsenic Wastes: Arsenic wastewater treatment standards are based upon results obtained by lime neutralization followed by manganese sulfate followed by ferric precipitation. Do the research design employed and weight of evidentiary data substantiate the proposed treatment levels as practicable and protective of human health and the environment?

Pretreatment of organo-arsenicals with peroxides or permanganates may be insufficient to oxidize the organic ligands. In Michigan Disposal's experience the treatment level proposed could not be reached for wastes containing chromium, a common constituent of arsenic wastes. Reduction of chromium is required in order to precipitate chromium hydroxide at high pH. The addition of oxidizing agents to destroy the organo-arsenic compounds will reoxidize the CrIII to CrVI and chromium will be leachable from the waste. Chromium arsenate will be a by-product which complicates the proposed process. Further study is suggested to support this approach. Thus we endorse the Agency's regulation of these wastes such that treated wastes no longer exhibit the hazardous characteristic (5.0 mg/L arsenic) prior to land disposal.

COMMENT NUMBER: 5-AA-2
DOCKET NUMBER: LD12-00113
COMMENTER: Michigan Disposal Inc.
ISSUE: Arsenic
SUBISSUE: Waste Segregation
RESPONSE

The Agency has reviewed additional data submitted by commenters for D004 wastes and has decided to set the wastewater D004 treatment standards at the characteristic level (i.e., 5.0 mg/l arsenic) because data submitted by other commenters has shown that arsenic may be present in more difficult to treat matrices than those present in D004 wastewaters from the veterinary pharmaceutical industry. The additional D004 data supplied by commenters demonstrated the difficulty in treating hexafluoroarsenate compounds.

Comment Number: 5-AA-3

Docket Number: LD12-00136

Commenter: Wayne Disposal

Issue: Arsenic/Selenium

Subissue: Segregation of arsenic wastes in landfills

Comment:

D004 Arsenic Wastes: Arsenic wastewater treatment standards are based upon results obtained by lime neutralization followed by manganese sulfate followed by ferric precipitation. Do the research design employed and weight of evidentiary data substantiate the proposed treatment levels as practicable and protective of human health and the environment?

Pretreatment of organo-arsenicals with peroxides or permanganates may be insufficient to oxidize the organic ligands. In Michigan Disposal's experience the treatment level proposed could not be reached for wastes containing chromium, a common constituent of arsenic wastes. Reduction of chromium is required in order to precipitate chromium hydroxide at high pH. The addition of oxidizing agents to destroy the organo-arsenic compounds will reoxidize the CrIII to CrVI and chromium will be leachable from the waste. Chromium arsenate will be a by-product which complicates the proposed process. Further study is suggested to support this approach. Thus we endorse the Agency's regulation of these wastes such that treated wastes no longer exhibit the hazardous characteristic (5.0 mg/L arsenic) prior to land disposal.

COMMENT NUMBER: 5-AA-3
DOCKET NUMBER: LD12-00130
COMMENTER: Wayne Disposal Inc.
ISSUE: Arsenic
SUBISSUE: Waste Segregation
RESPONSE

The Agency has reviewed additional data submitted by commenters for D004 wastes and has decided to set the wastewater D004 treatment standards at the characteristic level (i.e., 5.0 mg/l arsenic) because data submitted by other commenters has shown that arsenic may be present in more difficult to treat matrices than those prsent in D004 wastewaters from the veterinary pharmaceutical industry. The additional data supplied are for D004 wastewaters containing hexafluoroarsenate ions which must be hydrolyzed before arsenic can be precipitated as ferric arsenate.

Comment Number: 5-AA-4
Docket Number: LD12-00113
Commenter: Michigan Disposal, Inc.
Issue: Arsenic/ Selenium
Subissue: Segregation of arsenic wastes in landfills
Comment:

D010 Selenium Wastes: Assuming equivalency between arsenic and selenium in the absence of supporting data is an unsubstantiated approach. Further study is required to substantiate proposed treatment levels which are practicable and protective of human health and the environment.

COMMENT NUMBER: 5-AA-4
DOCKET NUMBER: LD12-00113
COMMENTER: Michigan Disposal
ISSUE: Selenium
SUBISSUE: Lack of Data
RESPONSE

The Agency has received additional data on stabilization of selenium-containing wastes and on treatment of wastewaters containing selenium. Separate revised treatment standards for selenium have been developed based on this new data.

Comment Number: 5-AA-5
Docket Number: LD12-00136
Commenter: Wayne Disposal
Issue: Arsenic/Selenium
Subissue: Segregation of arsenic wastes in landfills
Comment:

D010 Selenium Wastes: Assuming equivalency between arsenic and selenium in the absence of supporting data is an unsubstantiated approach. Further study is required to substantiate proposed treatment levels which are practicable and protective of human health and the environment.

COMMENT NUMBER: 5-AA-5
DOCKET NUMBER: LD12-00130
COMMENTER: Wayne Disposal
ISSUE: Selenium
SUBISSUE: Lack of Data
RESPONSE

The Agency has received additional data on stabilization of selenium-containing wastes and on treatment of wastewaters containing selenium. Separate revised treatment standards for selenium have been developed based on this new data.

Comment Number: 5-BB-1
Docket Number: LD12-L0046
Commenter: Thermal KEM
Issue: Arsenic / Selenium
Subissue: Hexafluoro Arsenate
Comment:

Lime Treatment is Not Demonstrated to be as Effective for Conventional Arsenic Removal as Ferric Salt Precipitation

Whereas lime treatment is a necessary process in Allied-Signal's wastewater application for acid neutralization and precipitation of fluoride iron, calcium is not a very effective agent for precipitating arsenate ion. Reference to CRS Handbook of Chemistry and Physics (57th Ed., 1976-1977 pp. B-98 and B-119) shows calcium orthoarsenate to have a solubility of about 113 ppm as $Ca_3(As0_4)2$, or 43 ppm as As, and ferric orthoarsenate to be insoluble to a point below practical solubility determination. This established fact alone is enough to conclude that lime treatment by itself would not meet BDAT even for "conventional" orthoarsenate removal.

After our review of this comment package we are left with concerns that in testing alternative technologies to lime treatment (specifically ferric salt precipitation) Allied-Signal may not have performed all the necessary steps, as we have described, for achieving the most effective arsenic removal possible. We also do not believe that lime treatment alone can be considered a substantially effective method for removing even the most common forms of arsenic in wastewater.

COMMENT NUMBER: 5-BB-1
DOCKET NUMBER: LD12-L00046
COMMENTER: Thermal KEM
ISSUE: Arsenic
SUBISSUE: Hexafluoroarsenate
RESPONSE

The Agency agrees with the commenter that lime treatment by itself is a relatively ineffective method for arsenic removal based on the solubility of calcium arsenate. However, the central point raised by the commenter is that Allied Signal has not proven that their failure to remove arsenic from wastewater is due to the presence of hexafluoroarsenate. The lime precipitation data supplied by Allied Signal show reductions of arsenic from 13 mg/l to 2.2 mg/l. However, the Agency believes that the hexafluoroarsenate cannot be removed by any simple precipitation and would have to be converted to another form that is amenable to precipitation. This belief is based on the published solubilities of hexafluoroarsenate salts and the data submitted by Allied Signal.

Comment Number: 5-CC-1
Docket Number: LD12-00113
Commenter: Michigan Disposal
Issue: Arsenic/Selenium
Subissue: Waste Treatment Levels
Comment:

D004 - D011 CHARACTERISTIC WASTES

The proposed rule established a standard for treatment which is one order of magnitude less than the EP toxic limits. The new standards are equally applicable to comparable U or P coded wastes. However, such materials are not chemically analogous to characteristic wastes which originate from various sources. Most actual wastes consist of complex mixtures that have many ionic, organic and inorganic species which influence their precipitation. It is easy to treat a pure mercury salt, finishing treatment with sulfide precipitation, and meet the BDAT treatment level proposed. If, however, organics or other metallic species such as hexavalent chromium are present, the BDAT standards will not easily be achieved.

Waste mixtures such as a nickel waste with chromium or a cyanide waste with chromium require dual treatments. They may require oxidation of cyanide followed by reduction (acidic) and final precipitation. Such stepwise treatment must be tailored to the requirements of the individual waste mixture. For this reason, more than any, the approach used and levels proposed for wastes D004-D011 represent an unrealistic oversimplification. BDAT must be established based upon demonstrated treatment of actual characteristic wastes which are by nature extremely complex.

D004 Arsenic Wastes: Arsenic wastewater treatment standards are based upon results obtained by lime neutralization followed by manganese sulfate followed by ferric precipitation. Do the research design employed and weight of evidentiary data substantiate the proposed treatment levels as practicable and protective of human health and the environment?

Comment Number: 5-CC-1 (cont.)

Docket Number: LD12-00113

Commenter: Michigan Disposal

Issue: Arsenic / Selenium

Subissue: Waste Treatment Levels

Comment:

Pretreatment of organo-arsenicals with peroxides or permanganates may be insufficient to oxidize the organic ligands. In Michigan Disposal's experience the treatment level proposed could not be reached for wastes containing chromium, a common constituent of arsenic wastes. Reduction of chromium is required in order to precipitate chromium hydroxide at high pH. The addition of oxidizing agents to destroy the organo-arsenic compounds will reoxidize the CrIII to CrVI and chromium will be leachable from the waste. Chromium arsenate will be a by-product which complicates the proposed process. Further study is suggested to support this approach. Thus we endorse the Agency's regulation of these wastes such that treated wastes no longer exhibit the hazardous characteristic (5.0 mg/L arsenic) prior to land disposal.

COMMENT NUMBER: 5-CC-1
DOCKET NUMBER: LD12-00113
COMMENTER: Michigan Disposal
ISSUE: Arsenic
SUBISSUE: Waste Treatment Levels
RESPONSE

The Agency has received additional data for D004 wastewaters and has decided to set treatment standards at 5 mg/l arsenic for nonwastewater TCLP leachate and wastewaters because this additional data indicates that arsenic may be present in more difficult to treat matrices than those present in wastewaters from the veterinary pharmaceutical industry. Whether any trivalent chromium in the same solution will also be oxidized to chromate will depend on the oxidizing agent used and the relative concentrations of chromium and organics present. Even if chromium is present, however, the arsenic can be precipitated as ferric arsenate in the oxidized solution, recovered and further treated by vitrification. The residual chromium containing solution can then be treated by chromate reduction and lime precipitation to yield a chromium hydroxide sludge. The Agency realizes that multi-step treatment processes may be needed for wastewaters containing two or more EP toxic metal constituents. However, these processes can be conducted in sequential operations.

Since the Agency set numerical treatment standards, the commenter may use any combination of treatment technologies to meet the standard.

Comment Number: 5-CC-2
Docket Number: LD12-00130
Commenter: Wayne Disposal, Inc.
Issue: Arsenic/Selenium
Subissue: Waste Treatment Levels
Comment:

D004 - D011 CHARACTERISTIC WASTES

The proposed rule established a standard for treatment which is one order of magnitude less than the EP toxic limits. The new standards are equally applicable to comparable U or P coded wastes. However, such materials are not chemically analogous to characteristic wastes which originate from various sources. Most actual wastes consist of complex mixtures that have many ionic, organic and inorganic species which influence their precipitation. It is easy to treat a pure mercury salt, finishing treatment with sulfide precipitation, and meet the BDAT treatment level proposed. If, however, organics or other metallic species such as hexavalent chromium are present, the BDAT standards will not easily be achieved.

Waste mixtures such as a nickel waste with chromium or a cyanide waste with chromium require dual treatments. They may require oxidation of cyanide followed by reduction (acidic) and final precipitation. Such stepwise treatment must be tailored to the requirements of the individual waste mixture. For this reason, more than any, the approach used and levels proposed for wastes D004-D011 represent an unrealistic oversimplification. BDAT must be established based upon demonstrated treatment of actual characteristic wastes which are by nature extremely complex.

> D004 Arsenic Wastes: Arsenic wastewater treatment standards are based upon results obtained by lime neutralization followed by manganese sulfate followed by ferric precipitation. Do the research design employed and weight of evidentiary data substantiate the proposed treatment levels as practicable and protective of human health and the environment?

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Comment Number: 5-CC-2 (cont)
Docket Number: LD12-00130
Commenter: Wayne Disposal, Inc.
Issue: Arsenic / Selenium
Subissue: Waste Treatment Levels
Comment:

Pretreatment of organo-arsenicals with peroxides or permanganates may be insufficient to oxidize the organic ligands. In Michigan Disposal's experience the treatment level proposed could not be reached for wastes containing chromium, a common constituent of arsenic wastes. Reduction of chromium is required in order to precipitate chromium hydroxide at high pH. The addition of oxidizing agents to destroy the organo-arsenic compounds will reoxidize the CrIII to CrVI and chromium will be leachable from the waste. Chromium arsenate will be a by-product which complicates the proposed process. Further study is suggested to support this approach. Thus we endorse the Agency's regulation of these wastes such that treated wastes no longer exhibit the hazardous characteristic (5.0 mg/L arsenic) prior to land disposal.

COMMENT NUMBER: 5-CC-2
DOCKET NUMBER: LD12-00130
COMMENTER: Wayne Disposal
ISSUE: Arsenic
SUBISSUE: Waste Treatment Levels
RESPONSE

The Agency has received additional data for D004 wastewaters and has decided to set treatment standards at 5.0 mg/l arsenic for nonwastewater TCLP leachate and wastewaters because this additional data indicates that arsenic may be present in more difficult to treat matrices than those present in wastewaters from the veterinary pharmaceutical industry. Whether any trivalent chromium in the same solution will also be oxidized to chromate will depend on the oxidizing agent used and the relative concentrations of chromium and organics present. Even if the chromium is present, however, the arsenic can be precipitated as ferric arsenate in the oxidized solution, recovered and further treated by vitrification. The residual chromium containing solution can then be treated by chromate reduction and lime precipitation to yield a chromium hydroxide sludge. The Agency realizes that multi-step treatment processes may be needed for wastewaters containing two or more EP toxic metal constituents. However, these processes can be conducted in sequential operations.

Since the Agency set numerical treatment standards, the commenter may use any combination of treatment technologies to achieve the standard.

Comment Number: 5-EE-1
Docket Number: LD12-L009
Commenter: American Wood Preservers Inst.
Issue: Arsenic /Selenium
Subissue: Treatability of Wastes
Comment:

Finally, and perhaps most critically, the pH of the material must be adjusted in preparation for the stabilization of the waste. First, recognizing that the solubility of chromium decreases with increasing pH (i.e., for chromium, minimizing solubility requires alkaline conditions) and solubility of arsenic, which is not separated from the chromium wastes, decreases with increasing alkalinity until a pH of 9 is achieved. At that point, the arsenic would go back into solution. And so for arsenic, minimizing solubility requires neutral conditions. These two conflicting factors are not addressed in the treatment method specified for K062.

COMMENT NUMBER: 5-EE-1
DOCKET NUMBER: LD12-L0002
COMMENTER: American Wood Preservers Inst.
ISSUE: Arsenic
SUBISSUE: Solubilities
RESPONSE

The Agency has not specified a treatment method for wood preserving wastes. The Agency has merely proposed treatment standards for the chromium and arsenic contents of D007 and D004 wastes, respectively. The Agency realizes that a sequence of treatment procedures may be required to properly treat both toxic constituents in a waste. Facilities are free to choose any one or combinations of treatment procedures which will achieve the desired results. The Agency notes, however, if vitrification is used, both chromium and arsenic will become chemically fixed in the glass.

Comment Number: 5 - FF - 1
Docket Number: L012-00138
Commenter: OxyChem
Issue: Arsenic
Subissue: Vitrification
Comment:

EPA's Treatment Standard For Arsenic Containing Non-Wastewaters (D004) is Based on a Technology That is Not Commercially Available. Therefore, It Should Be Changed To Allow For Alternative Technologies.

The BDAT treatment standard proposed by EPA (54 Fed. Reg. 48433) is based on vitrification, a hazardous waste stabilization process that is not known to be commercially available. Because the Arsenic/Selenium Background Document was not able to be obtained in time to be reviewed for these comments, OxyChem is at somewhat of a disadvantage. However, as one of only five known generators of a D004 arsenic containing nonwastewater hazardous waste, we are unaware of a commercial vitrification process which can be applied to that waste.

The Agency discounts cementitious stabilization for arsenic containing nonwastewaters because it has data on a waste (K031) which contain extremely high arsenic levels. It is stated (54 Fed. Reg. 48431) that the Agency has data which indicates relatively low levels of arsenic in nonwastewaters may be adequately stabilized through cementitious or pozzolonic processes. However, the Agency states the leachability data from these types of stabilization is not reproducible. OxyChem disagrees with this characterization of the data reproducibility. We believe there is adequate data to demonstrate that stabilization processes using cement provide a very stable material which does not leach significant levels of arsenic.

COMMENT NUMBER: 5-FF-1
DOCKET NUMBER: LD12-00158
COMMENTER: OxyChem
ISSUE: Arsenic
SUBISSUE: Standards deficiencies
RESPONSE

The Agency used all the data to which it has access in developing the D004 treatment standards. During the comment period, commenters supplied information on the availability of vitrification equipment and on vitrification of D004 arsenic sulfide wastes. Data were also received on stabilization and precipitation technologies as well. The Agency has used the vitrification performance data to support the promulgation of treatment standards for D004 at a level of 5.0 mg/l for nonwastewater TCLP leachate and wastewaters. The Agency believes that vitrification is BDAT for D004 wastes. However, a facility is not precluded from using alternative treatment technologies to achieve the numerical treatment level for D004 wastes.

Comment Number: 5-FF-2
Docket Number: LD12-00266
Commenter: Penberthy Electromelt Int
Issue: Arsenic
Subissue: Vitrification
Comment:

Page 48433, col. 1. The object of this vitrification of arsenic/selenium is to make a waste form so good that these elements are out of the biosphere forever. The Venetians led the way 1000 years ago with glasses that are still in good condition today. We can make glasses which are 100 times better. With proper technique and technology, the arsenic/selenium glass can be delisted, which is the goal of Congress.

COMMENT NUMBER: 5-FF-2
DOCKET NUMBER: LD12-00266
COMMENTER: Penberthy Electromelt
ISSUE: Arsenic
SUBISSUE: Vitrification
RESPONSE

The Agency agrees with the commenter that some residues may be delistable but emphasizes that all residues must go through the appropriate regulatory process to be delisted by EPA.

Comment Number: 5-FF-3

Docket Number: LD12-00266

Commenter: Penberthy Electromelt Int

Issue: Arsenic

Subissue: Vitrification

Comment:

Page 48432, col. 3. Note that glasses are better than slags for leaching resistance because glasses do not have any intercrystalline planes into which water can penetrate.

COMMENT NUMBER: 5-FF-3
DOCKET NUMBER: LD12-00266
COMMENTER: Penberthy Electromelt
ISSUE: Arsenic
SUBISSUE: Vitrification
RESPONSE

The Agency has no data to indicate that glass has better leaching resistance than slags. However, data does indicate that glass and slag vitrification both meet the treatment standards for arsenic nonwastewaters.

Comment Number: 5-FF-4
Docket Number: LD12-00266
Commenter: Penberthy Electromelt Int
Issue: Arsenic
Subissue: Vitrification
Comment:

Page 48432, col. 2. Organo-complexes of arsenic and selenium can be treated and vitrified in a combined combustion/vitrification furnace as shown in Pat 4,299,611. Part of the arsenic will vaporize, but will be caught in the ceramic fiber filter in the flue and returned to the melt for vitrification. This furnace is called "warm-top".

COMMENT NUMBER: 5-FF-4
DOCKET NUMBER: LD12-00266
COMMENTER: Penberthy Electromelt
ISSUE: Arsenic
SUBISSUE: Vitrification
RESPONSE

The Agency agrees with Penberthy Electromelt, but believes that when vitrifying some high organic wastes an afterburner may be necessary to destroy the organics.

Comment Number: 5-FF-5

Docket Number: LD12-00266

Commenter: Penberthy Electromelt Int

Issue: Arsenic

Subissue: Vitrification

Comment:

Ref FR page 48430, col. 2. There is no objection to the use of sulfide as the precipitating reagent for arsenic when vitrification is the final BDAT, since the sulfide aspect can be managed by melt chemistry.

Calcium and ferric arsenates and arsenic oxide are also OK for vitrification, in the same furnace as for the sulfide.

There is no need for requiring segregation of the arsenic-containing glass from lime-based alkaline materials, since the composition of the glass is chosen to be long-term resistant to lime-based alkalinity. The glass is also stable against sea water, and against asphalt in paving.

Insoluble arsenic-containing glasses have been prepared having an As content of 5%. This is high enough for commercial and technical feasibility. The upper limit is not established. Recovery of arsenic should not be contemplated because there is no available market for arsenic. However, there is beneficial use for the vitreous form.

COMMENT NUMBER: 5-FF-5
DOCKET NUMBER: LD12-00266
COMMENTER: Penberthy Electromelt
ISSUE: Arsenic
SUBISSUE: Vitrification
RESPONSE

The Agency thanks the commenter for the factual information and agrees with Penberthy Electromelt that vitrification can be used to treat various arsenic wastes.

Comment Number: 5-GG-1
Docket Number: LD12-00050
Commenter: HWTC
Issue: Arsenic | Selenium
Subissue: Data
Comment:

The Hazardous Waste Treatment Council (HWTC) submits the attached data concerning the treatability of a number of wastes identified in the proposed Third-Third regulation (54 FR 48372, November 22, 1989).

Comment Number: 5-GG-1
Docket Number: LD12-C0050
Commenter: HWTC
Issue: Arsenic | Selenium
Subissue: Data
Comment:

The Hazardous Waste Treatment Council (HWTC) submits the attached data concerning the treatability of a number of wastes identified in the proposed Third-Third regulation (54 FR 48372, November 22, 1989).

COMMENT NUMBER: 5-GG-1
DOCKET NUMBER: LD12-00050
COMMENTER: HWTC
ISSUE: Arsenic/Selenium
SUBISSUE: Data
RESPONSE

The Agency appreciates the Hazardous Waste Treatment Council's submission of waste stabilization performance data. The Agency has considered this information along with data supplied by other commenters and has issued revised treatment standards for D004 and D010 wastes. The data submitted by the commenter consisted of two submittals for a total of four subsets of stabilization data on arsenic and selenium wastes.

One subset of data consisted of stabilization data on four arsenic containing wastes ranging in arsenic content from 6.5 to 602 parts per million arsenic. The chemical form of the arsenic present was not disclosed and these wastes were viewed as being much lower in arsenic content than the arsenic wastes typically generated by some segments of the chemical industry which contain from 20,000 to 80,000 parts per million arsenic.

A second subset of data consisted of stabilization data on soils spiked with various arsenic and selenium compounds. Regular TCLP data and data from a modified TCLP test conducted at pH 10.5 were presented. These spiked soil samples represented laboratory simulations of wastes and not wastes actually generated from industrial sources.

A third subset of data consisted of stabilization data on wastes containing selenium at levels below 10 parts per million. The selenium contents of these wastes and the number of samples studied (three) were judged to be too low to be representative of typical selenium containing wastes.

COMMENT NUMBER:	5-GG-1 (continued)
DOCKET NUMBER:	LD12-00050
COMMENTER:	HWTC
ISSUE:	Arsenic/Selenium
SUBISSUE:	Data

RESPONSE

A fourth subset of data consisted of stabilization data on a mining waste which was a baghouse dust from a copper smelter. The stabilization data for selenium from this subset is being used by EPA to develop standards for D010 nonwastewaters. The data for arsenic, however showed TCLP leachate values ranging from 8 to 166 mg/l arsenic in the leachate. These numbers are all significantly above the characteristic level for arsenic and the Agency feels that this data merely reenforces the Agency's position that stabilization alone, without chemical pretreatment, may not be sufficient to ensure safe disposal of D004 wastes. Vitrification data, on the other hand, show that arsenic wastes can be treated to below characteristic levels more consistently.

However, the Agency realizes that vitrification and other technologies employing complex treatment trains such as chemical oxidation, ferric precipitation, and stabilization in series have limited current capacity. As a result, the Agency has granted a capacity variance for D004 nonwastewaters.

Comment Number: 5-GG-2
Docket Number: LD12-L005.1
Commenter: Solidiwaste
Issue: Arsenic/Selenium
Subissue: Data
Comment:

Further to our letter of the 19th of December, 1989, Mr. Rissmann of Vesar telephoned requesting further information on treating arsenic wastes.

Samples SW-AA, SW-P, SW-Q are from a contaminated soil project. SW-B is arsenic sulfide waste from food grade phosphoric acid production. The major factor in successful treatment utilizing solidification is final pH of the mix. However, in the case of SW-B you will see the final pH was 11. But, initial was 6. Pretreatment of this waste allowed for successful results, 35000 ppm to 0.08 ppm with final pH 11. In this instance the treatment of arsenic sulfide differs in some part from arsenic oxide.

Please find attached our report from Dr. Chou. If you have any further questions please do not hesitate to call.

Over the past four years we have been working on solidification of non-wastewater arsenic wastes. In the last two months we have been successful in treatment to a level below the current 5 ppm. Over the next 120 days we will be treating and testing on a weekly basis.

Original concentrations are from 30 t6o 50,000 ppm. Our results using TCLP are .08 ppm. It is felt that solidification is far more cost effective than vitrification, which would surely fail if TCLP extraction was used. We would like you to consider our URRICHEM process for BDAT at the current level of 5 ppm rather than the proposed 5.6 ppm.

COMMENT NUMBER: 5-GG-2
DOCKET NUMBER: LD12-L0061
COMMENTER: Solidiwaste
ISSUE: Arsenic
SUBISSUE: Data
RESPONSE

The data submitted by the commenter consisted of stabilization data on two samples of arsenic sulfide waste using proprietary formulations. The Agency considered but did not use the data submitted by the commenter because, while the data showed a D004 waste could be properly treated by stabilization, the Agency could not determine the applicability of the technology to all types of D004 nonwastewaters. The data showed concentrations of 0.08 mg/l are attainable for high As wastes. However, the commenter's data is based on the use of proprietary additives which may have converted the arsenic present into an insoluble compound such as ferric arsenate. The chemical composition of the additives was not provided.

The Agency feels that the vitrification process is applicable to all forms of D004 nonwastewaters. The numerical regulations for D004 wastes were based on data from the vitrification process. However, facilities are free to use other treatment methods to meet the proposed standards.

Comment Number: 5-GG-3

Docket Number: LD12-00045

Commenter: Bethlehem Steel

Issue: Arsenic/Selenium

Subissue: Data

Comment:

Bethlehem appreciates this opportunity to submit information and comments to fill data gaps relative to selenium-containing wastewater treatment technology. If you have any questions concerning this matter or if you desire additional data, please call me at (215) 694-2721 or R. K. Chaturvedi of my staff at (215) 694-2055.

COMMENT NUMBER: 5-GG-3
DOCKET NUMBER: LD12-00045
COMMENTER: Bethlehem Steel
ISSUE: Selenium
SUBISSUE: Data
RESPONSE

The Agency thanks Bethlehem Steel for submission of data on D010 wastewaters. The Agency notes that all treatment data presented by the commenter was performed at or near neutral pH. According to other commenters, precipitation of selenium from solution requires a pH of less than 3.0. At neutral pH values, the chemical reduction of selenium occurs only very slowly. For that reason, the Agency is not using the commenter's data as the basis for a numerical treatment standard.

Comment Number: 5-GG-4
Docket Number: LDI7-00073
Commenter: Chem Fix
Issue: Arsenic/Selenium
Subissue: Data
Comment:

I have attached data from (1) K-048 sludge stabilization and (2) An acid production by product liquid with a very high arsenic concentration. In each of the cases, a CHEMSET™/CHEMFIX® Process was employeed.

COMMENT NUMBER: 5-GG-4
DOCKET NUMBER: LD12-00073
COMMENTER: Chemfix
ISSUE: Arsenic/Selenium
SUBISSUE: Data
RESPONSE

The Agency has examined the stabilization data on two samples submitted by the commenter. The data shows that, using proprietary stabilization mixtures, several arsenic wastes can be stabilized (see e.g., comment of CWM that stabilization is not uniformly effective for D004 wastes). The Agency also examined stabilization and vitrification data from other sources and decided to set the numerical waste treatment standards for D004 nonwastewaters at 5.0 mg/l in the TCLP leachate for nonwastewaters and for wastewaters. Facilities are free to use whatever treatment methods are necessary to comply with the standards.

Comment Number: 5-GG-5

Docket Number: LD12-00198

Commenter: DOE

Issue: Arsenic/Selenium

Subissue: Data

Comment:

DOE's comments are presented in the attached documentation. These comments incorporate the combined viewpoints of both DOE Program Offices and Operations Offices, including issues identified by the Richland Operations Office, Savannah River Operations Office, and Chicago Operations Office.

COMMENT NUMBER: 5-GG-5
DOCKET NUMBER: LD12-00198
COMMENTER: DOE
ISSUE: Arsenic/Selenium
SUBISSUE: Stabilization Data
RESPONSE

The Agency thanks the Department of Energy for its submittal of data on stabilization of simulated wastes containing EP toxic metals. The Agency, however, did not use this data because it consisted of tests on simulated wastes as opposed to tests on actual wastes. The Agency, however, considered this data, along with that from other commenters and has decided to set numerical treatment standards for D004 wastes based on vitrification technology. Since the standard is a numerical value, facilities may use other treatment methods for compliance.

For D010 wastes the data submitted corroborate that submitted by other commenters that wastes containing low concentrations of selenium can be stabilized. The Agency has based D010 treatment standards on stabilization. Facilities are free to use other treatment methods to comply with the standards.

Comment Number: 5-GG-6
Docket Number: LD12-00044
Commenter: ThermalKEM/CyanoKEM
Issue: Arsenic/Selenium
Subissue: Data
Comment:

Submitted with this letter are the original, plus two copies of a data package prepared on treatability of arsenic wastes for consideration for the Third Thirds final rule on land disposal restrictions. Based on this data set, we have justified treatment standards of 1.67 mg/L arsenic for wastewater and 2.99 mg/L TCLP leachable arsenic for non-wastewater treatment residue.

COMMENT NUMBER:	5-GG-6
DOCKET NUMBER:	LD12-00044
COMMENTER:	ThermalKEM
ISSUE:	Arsenic
SUBISSUE:	Data Submission

RESPONSE

The agency appreciates the receipt of data from ThermalKEM on incineration, chemical treatment and stabilization of arsenic wastes and treatment of arsenic wastewaters. The wastewater data corroborated data the Agency had received from other sources. The nonwastewater information showed that for pure D004 wastes, chemical treatment plus stabilization appears to be a viable alternative to vitrification. The treatment standards for D004 wastes are established at 5.0 mg/l in the TCLP leachate for nonwastewaters and for wastewaters. The commenter's data indicate that the standard can be met using stabilization for the wastes tested. However, the wastes treated contained forms of arsenic which are easier to treat than those contained in other wastes. That is, arsenic acid and arsenic oxide are easily converted to ferric arsenate. Organo arsenates or other forms of arsenic can be oxidized and fixed as ferric arsenate but the process may be more problematic. As a result, the Agency was uncertain if these treatments would yield the same results with arsenic present in other chemical forms in wastes. Facilities are free to use other treatments to comply with the numerical treatment standards.

Comment Number: 5-GG-7
Docket Number: LD12-00060
Commenter: Applied Engineering & Science
Issue: Arsenic/Selenium
Subissue: Data
Comment:

Enclosed are additional data supporting the selection of chemical fixation, rather than vitrification, as the BDAT for K031 nonwastewaters. On behalf of Southern Pacific Transportation Company, we will be submitting additional comments on the appropriate BDAT for K031 nonwastewaters and on other issues by the January 8, 1990 deadline.

COMMENT NUMBER: 5-GG-7
DOCKET NUMBER: LD12-00060
COMMENTER: Applied Science and Engineering
ISSUE: Arsenic
SUBISSUE: Data
RESPONSE

The Agency has reviewed the commenters data which consist of the results of stabilization tests on one form of K031 wastes using undisclosed stabilizing formulations. The Agency did not use the data to develop a treatment standard for arsenic because the stabilization data received from different sources for D004 and K031 wastes showed in some instances conflicting results depending upon the percent of ferric arsenate salts versus other forms of arsenic. The term stabilization refers to a broad range of processes, some of which include prior chemical treatment and some of which do not. The Agency feels that this is a major reason for the differences in stabilization results which various commenters have submitted.

Vitrification data, on the other hand showed a consistent performance. Hence, the Agency developed a numerical treatment standard based on the vitrification data. However, facilities are free to use other waste treatment methods to comply with the numerical treatment standard.

Comment Number: 5-GG-8
Docket Number: LD12-00038
Commenter: Applied Engineering & Science
Issue: Arsenic/Selenium
Subissue: Data
Comment:

Enclosed are additional data supporting the selection of chemical fixation, rather than vitrification, as the BDAT for K031 nonwastewaters. On behalf of Southern Pacific Transportation Company, we will be submitting additional comments on the appropriate BDAT for K031 nonwastewaters and on other issues by the January 8, 1990 deadline.

COMMENT NUMBER: 5-GG-8
DOCKET NUMBER: LD12-00038
COMMENTER: Applied Science and Engineering
ISSUE: Arsenic
SUBISSUE: Data
RESPONSE

The Agency has reviewed the commenters data which consist of the results of stabilization tests on one form of K031 wastes using undisclosed stabilizing formulations. The Agency did not use the data to develop a treatment standard for arsenic because the stabilization data received from different sources for D004 and K031 wastes showed in some instances conflicting results. The Agency believes that one possible cause for the differences is the use of oxidants and iron salts as proprietary additives in the more successful formulations. This may account for the wide range of results reported in stabilization tests for D004 wastes. Vitrification data, on the other hand showed a consistent performance. Hence, the Agency developed a numerical treatment standard based on the vitrification data. However, facilities are free to use other waste treatment methods to comply with the numerical treatment standard.

Comment Number: 5-HH-1
Docket Number: LD12-L0043
Commenter: Fermenta
Issue: Arsenic
Subissue: Wastewater BDAT
Comment:

Wastewater BDAT

- Fermenta concurs with EPA that chemical precipitation is the "best" performing technology for wastewater forms of arsenic-bearing wastes and that alternative technologies such as ion exchange or carbon adsorption may equal, but are unlikely to improve the level of performance. Fermenta data submitted to EPA on January 8, 1990 indicates that chemical precipitation using ferric chloride coprecipitation can successfully remove inorganic and organic arsenic from D004 and K031 wastewaters and that treatment residues are stable to groundwater leaching.

COMMENT NUMBER: 5-HH-1
DOCKET NUMBER: LD12-L0043
COMMENTER: Fermenta
ISSUE: Arsenic
SUBISSUE: Chemical Fixation
RESPONSE

The Agency thanks the commenter for its data and concurs that chemical precipitation is the best method for removal of arsenates from wastewaters. The Agency notes, however, that other forms of arsenic should first be oxidized to arsenates before precipitation from solution as ferric arsenate. Salts of organoarsenates may undergo slow oxidation in the environment over time resulting in a release of the arsenic. For this reason, the Agency feels chemical oxidation is needed to first convert other arsenic species to arsenates prior to chemical precipitation.

Comment Number: 5-II-1
Docket Number: LD12-00138
Commenter: Oxychem
Issue: Arsenic / selenium
Subissue: Deficiencies in standards
Comment:

The Proposed Standards for Metal Wastes (Characteristic, "U" and "P") Suffer From the Same Deficiencies as the Standards for Other Characteristic Wastes. The Agency Has Attempted To Characterize the Treatability of a Universe of Wastes Using Data for a Few Wastes That Cannot Possibly Be Representative of This Universe.

In the preamble to the proposed standards for specific metal-bearing wastes, the Agency outlines its approach to establishing concentration-based treatment standards for these wastes (54 Fed. Reg. 48429). In essence, the Agency has proposed all such limits on the basis of treatability data for a very limited number of wastes containing these metals. By its own admission, "characterization data on many of these metal wastes are limited."

As EPA admits, it has very limited data that can be used to characterize the metal-bearing wastes, yet it proposes to establish stringent standards for such wastes based on limited treatability data. This approach is simply bad science. Specific examples of the inadequacy of EPA's data "analysis" are presented in comments on specific waste codes. However, the overall conclusion that must be drawn is that the Agency's entire methodological approach to concentration-based treatment standards for the metal wastes is fundamentally flawed and technically unjustifiable.

COMMENT NUMBER: 5-II-1
DOCKET NUMBER: LD12-00138
COMMENTER: OxyChem
ISSUE: Arsenic
SUBISSUE: Standards Deficiencies
RESPONSE

The Agency has continued to urge the impacted industries to submit treatment data for wastes in order to expand the amount of treatment data available to the Agency. During the comment period, the Agency received a considerable amount of additional data for the treatment of arsenic and selenium-containing wastes. This data indicated there are some forms of D004 wastewaters which are more difficult to treat than those already studied. As a result, the Agency has revised the treatment standards for arsenic.

Comment Number: 5-II-2
Docket Number: LD12-00138
Commenter: Oxychem
Issue: Arsenic/selenium
Subissue: Inconsistant standards
Comment:

G. The Agency States That Its Proposed Standard for Arsenic in Wastewaters (D004) Is Based Upon the Most Difficult To Treat Wastewater Matrix. However, the Alternate Treatment Standard for Arsenic, Which Is Based on Wastewater Treatment Data Using the Same Technology as Was Used by the Facility From Which the Proposed Standard is Developed Is 76 Percent Greater Than That Proposed by EPA.

EPA discusses the data base for its calculation of the proposed treatment standard for arsenic-containing hazardous wastewaters at 54 Fed. Reg. 48430. The data are from a veterinary pharmaceuticals facility that uses three-stage alkaline precipitation to remove arsenic from its wastewaters. The calculated treatment standard is 0.79 mg/l.

In the Background Document for wastewaters containing BDAT list constituents (LD12-S1061), EPA presents a calculated arsenic standard of 1.39 mg/l. This standard is based on alkaline precipitation, followed by filtration. This treatment sequence uses an additional technology (filtration) added to the basic alkaline precipitation step, yet results in a higher treatment standard than that derived by EPA from the pharmaceuticals data. It is thus apparent that EPA has not based the proposed BDAT standard on the most difficult to treat wastewater.

This is an example of the danger of establishing a concentration-based treatment standard for characteristic wastes using a single facility's waste. There is no way to know if the standard can be achieved for a dissimilar waste, and there is no way to assure that such dissimilar wastes do not exist.

If the Agency persists with the concentration-based standards that are below the characteristic level, then it should use the alternate standard based on wastewater treatment data for arsenic.

COMMENT NUMBER: 5-II-2
DOCKET NUMBER: LD12-00138
COMMENTER: OxyChem
ISSUE: Arsenic
SUBISSUE: Inconsistent Standards
RESPONSE

The treatment standard for D004 wastewaters is based on a three stage treatment system using lime, managanese and ferric ion precipitation in series with filtration after each step. Further data supporting the standard may be found in the ferric arsenate precipitation data found in the D004 background document. The Agency has data from two other sources showing ferric arsenate precipitation alone can reduce arsenic levels in D004 wastewaters to below 0.6 mg/l if excess ferric ion is used.

However, the Agency realizes that there are more difficult to treat D004 wastewaters than those produced in the veterinary pharmaceuticals industry. Specifically, hexafluoro arsenates when present are difficult to convert to ordinary arsenates so that they can be fixed as iron arsenate.

Also, in the process of reevaluating the D004 waste treatment data, EPA discovered an error in the calculation of the promulgated K101 and K102 for metal constituents. The Agency is correcting this error by analyzing the wastewater standards for metal constituents.

Comment Number: SKR1

Docket Number: LDR2-00256

Commenter: [illegible]

Issue: Arsenic

Subissue: Treatment above characteristic level

~~Response:~~ Comment

We also ask for clarification of the land disposal options available for those wastes which are treated so that they meet or exceed the standards contained in the rule. The proposed rule makes several references to disposal in a "Subtitle C" facility. Do wastes which have been treated as specified remain subject to Subtitle C (assuming that treatment of characteristic wastes produces results lower than those which define the waste as hazardous)?

COMMENT NUMBER: 5-KK-1
DOCKET NUMBER: LD12-00256
COMMENTER: FNC
ISSUE: Arsenic
SUBISSUE: Treatment to Above Characteristic Level
RESPONSE

The proposed treatment standard for D004 nonwastewater wastes was 5.6 mg/l arsenic in the TCLP leachate. This value is above the characteristic level of 5.0 mg/l in the TCLP leachates. Wastes treated to below the treatment standard for D004 wastes but above the corresponding characteristic level remain subject to Subtitle C regulations. This point is moot, however, because the Agency has revoked the proposed standards and is promulgating a treatment standard of 5.0 mg/l for D004 nonwastewaters.